


GUNSMITHING: PISTOLS & REVOLVERS

PATRICK SWEENEY

**Do-It-Yourself Projects,
Diagnosis and Repair
for Pistols and
Revolvers**

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- **Techniques:**
Filing, Polishing,
Joining, Refinishing
 - **Tools:**
How to Choose and Use
 - **Theory:** How Pistols
and Revolvers Operate
 - **Tuning and Timing**
Revolvers
 - **Accurizing**

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PATRICK SWEENEY

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I would like to thank the manufacturers who so kindly sent me samples to play with and photograph. Without their assistance a project of this type would be almost impossible.

I would also like to thank all of those in the gunsmithing community who were so kind and patient in answering my questions about tools and techniques. At one point during this project I was calling back and forth across the country, trying to figure out why two well-known and respected gunsmiths would do the same thing in such a different manner. As the answer to that question ended up being more philosophical than concrete, I left it unanswered.

But most of all I would like to thank Felicia for her patience, persistence, encouragement and time. Without her forbearance and encyclopedic knowledge of the language, the book you hold would be fatter, less useful, and late. As much as I owe to my fellow gun experts, I owe many times that to her, the life expert.

About The Author

Patrick Sweeney has the kind of background that would sell a mystery novel just from the dust jacket: After graduating with a degree in Chemistry, he worked as a martial arts instructor, in the security/investigation industry, did a stint as a professional photographer, and worked as a radio announcer. He used to race dirt bikes, and even spent a summer skydiving, both endeavors cut short by the spectacle of fellow participants suffering injuries.

A lifelong shooter, he began practical shooting competition in the late 1970's, and has successfully competed in the USPSA National Championships, Second Chance, The Steel Challenge and The Masters. He has been to Gunsite Training Center a number of times, and attended classes taught by John Farnam, Massad Ayoob, Bill Rogers and Jerry Barnhart.

He switched to gunsmithing in the early 1980's and has worked full-time since then as a general gunsmith in a large Midwest metropolitan area. No, he is not planning to write a mystery novel.

The Basics



Chapter 1 - Pistolsmithing For Fun

There is no secret body of knowledge in pistolsmithing, no set of mysterious “tricks” handed down from one generation of pistolsmiths to another. Yes, much of what is done by professional pistolsmiths is done behind closed doors, but not to be mysterious. The door is closed to keep the customer from jostling the pistolsmith’s elbow or asking distracting questions.



If the slide and frame were clear, you could watch everything as it happens. Unfortunately, steel is not transparent.



Handguns are expensive, and you do not have the luxury of experimenting. If you make too great a mistake, you may have to buy a new handgun. Go slow.

But if it isn’t all a really big secret, and if you could look behind that door, what would you see? What do you need to work on your own handguns?

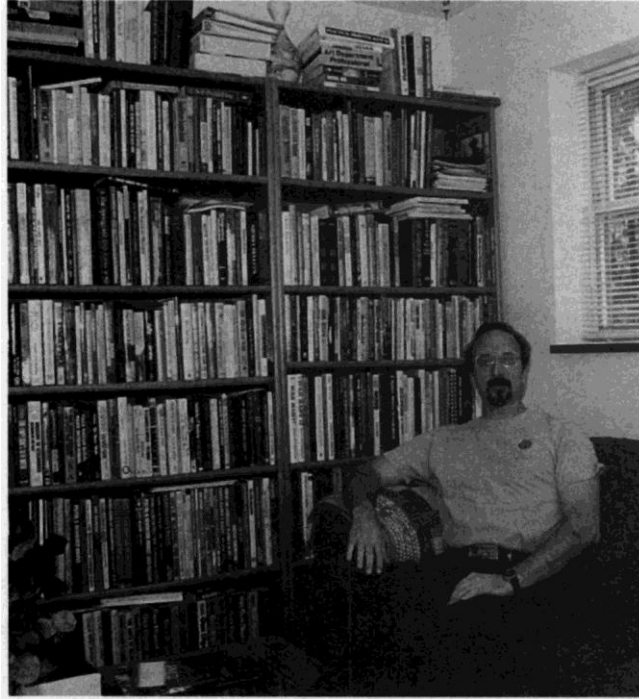
You need patience. Unless you have a large budget you will not have the luxury of scrapping a few pistols in order to learn the tasks quickly. You have to learn “on the job”. As Dean Grennell, long-time author and reloading expert has pointed out, skeet and trap shooters seem to have large amounts of cash to drop into their shotguns. Handgun shooters do not. In order to learn as you go, patience will be your constant companion.

You need the right tools. The kinds of tools usually found in the home workshop are not at all suited for the task of pistolsmithing. While you may have files out in the garage, they are too coarse, too rusty and too worn to be of any use working on a pistol. Your screwdrivers are probably sized wrong and ground incorrectly, and the faithful claw hammer you used to frame your garage is a poor substitute for the hammers you will need. What do the professionals use? Almost always they use the best. The cost difference between the best file and a file that is “good enough” is small. The best file will last longer and cut cleaner than the average or low-cost file. The same goes for parts; a top-quality part lasts longer and requires less work to fit to your handgun because it is made to tighter tolerances than the cheaper competitors.

Do you need a fully-equipped machine shop to do good or even excellent pistolsmithing? Not really. For decades at Camp Perry the various factory armorers and Service Teams have had all their needs handled by the tools and equipment that would fit into a small trailer. If you do have a machine shop in your basement or garage, or if your uncle has just left you one in his will, great. But don’t go out and buy a bunch of power tools just because you think you must have them to do any pistolsmithing.

What do you need besides patience and the right tools? You need this book. Many texts directed at professional pistolsmiths assume the reader already has a large base of knowledge and experience. Random experimentation can be expensive, frustrating and painful. While I have made a few mistakes in my 15 years of professional work, I have seen thousands more brought in by my customers after unguided do-it-yourself efforts. This book can pilot you through those dangerous rapids on your rafting trip to pistolsmithing rewards. For the shooters and readers who want to get the job done right the first time this book is the beginning of your adventure.

What can you do at home, working on your own? Provided you have the right tools, more than you might think. Replacing parts such as sights and barrels, checkering and stippling metal work, delicate stoning of trigger parts for a better trigger pull—all are within the ability of the shooter who wants to do his own work. A small torch will give you all the heat needed to do soldering of all types. The right basic tools make cleaning and polishing a cinch.



There is no such thing as too much information. This is only part of the author's firearms and gunsmithing library.



A messy workbench is an invitation to damage tools, lose parts and hurt yourself. Keep the bench clear of extraneous parts and tools.

With a few specialized tools you can do much more advanced work. For example, with the right fixture you can thread your own barrels to install a compensator. With a large drill press you can drill and tap holes for a scope base. With a mill you can do any type of sight installation, including the popular Novak Low mount on a Colt 1911 pistol.

Still, there are jobs beyond the range of the small home workshop. Every year many optimistic shooters decide they can drill the holes for a scope base with a variable-speed drill. Even with a small drill press this takes patience and a bit of practice. With a hand-held drill it's a disaster. Usually these optimists give up after the first hole, right after they find out that the steel used in pistol frames is a lot tougher than the steel they are accustomed to drilling around the house. Too late. If they haven't made too much of a mess of things the damage can be repaired with some silver-soldering or welding. Similarly, without a mill you cannot install a low-mount sight on your pistol, such as the Novak low-mount or the BoMar sight melted into the slide.

Take all your welding to a professional. Always. Welding for handguns is an entire level of skill above welding a broken foot-pedal back onto the garden tractor. Properly done welding requires expensive equipment that you have to use daily to keep the touch.

Additional jobs best left to the professional include many surface finishes, and heat treatments.

These processes require dedicated space, expensive and elaborate tanks, and chemicals. Nasty chemicals. The chemicals themselves are expensive, dangerous and require correct professional disposal when they are exhausted. Using them incorrectly can kill you. Disposing of them incorrectly can land you in prison. About the only finish besides cold blue you could do would be a baked-on epoxy finish. And this only if you are scrupulous about cleaning the oven afterwards.

The matter of taste always comes up in discussions of pistolsmithing, and I used to think it was because some people had an innate need to argue. You should approach modifications to your handgun by asking yourself three questions: (1) “Will it improve my shooting?” (2) “Will it improve my comfort?” and (3) “Will I like the way it looks?” Notice that nowhere in those three questions are you consulting someone else. While improved shooting skills and comfort can be measured, looks are an intangible that each of you must decide for yourself. If you feel that a particular part looks good then who am I to argue? Many years ago I found a handgun on our range at the end of a match, a handgun that was surpassingly ugly. I mean, so ugly it would take your breath away to look at it. Curious, I test-fired it. The “ugly gun” was as accurate and reliable as it was ugly. This handgun changed my attitude about the importance of looks and finish on a working tool, and I have had occasion to think about that pistol several times a year since.

Do not let your pursuit of the correct “look” allow you to accept shabby workmanship. The raciest parts, installed clumsily, will not have the desired effect. And sloppy workmanship can also be unsafe. Be safe!

Your budget and aspirations will dictate the amount of equipment you end up with. But more important than the equipment is skill and knowledge. The best tools in the world are useless without knowing how to use them. This book will give you a look behind the pistolsmith’s door.

And what would you see if you could peer over that professional’s shoulder? Your pistolsmith, happy as a clam, working on handguns all day long, something he or she loves to do.

So read on, and soon you’ll be taking care of most of your pistolsmithing needs without having to send your handgun off to strange places. And you’ll be keeping all that fun for yourself.

In the old days the aspiring pistolsmith had to make almost everything that was needed, from drawings of the proper dimensions to screwdrivers, from files to fixtures. That is not the case today. Oh, you can still make everything you need if you want to. Many shooters and pistolsmiths do so for many reasons. They may have budget restraints or an immediate need for the tool. They may not have found the toolmaker who makes the gizmo they want. If you love to tinker, make your own tools. That is another book entirely. Right now we’ll concentrate on tools that are readily available.

When it comes to catalogs of pistolsmithing tools, parts, fixtures, and knowledge, the Brownells catalog is by far the best. Starting right after WWII, Frank Brownell began dealing in gunsmithing tools. He didn’t limit his catalog to just the tools he made, but also became a dealer for other makers of tools and fixtures. Currently over 250 pages, the basic motto of Brownells catalog seems to be “If we don’t have it, we’ll find it for you”.

Brownells catalog is very well laid out and organized.

Every item has a clear photograph of the part in question so you can easily see what it is. If you wanted to buy a barrel for your 1911 just look up “Barrels, 1911”. Like-items are grouped together. Flip to any other section and you can see all the specifications for the different manufacturers’ offerings there in a group. You won’t have to flip back and forth to compare two or three of them.

Looking at the catalog for the first time you will be tempted to start ordering all kinds of stuff: things you must have, things you want to have, and things that look like they would save you lots of time.

Unless you are working with someone else’s credit card, I would advise restraint. You need a little to get started, and the rest can be ordered when you need it. While drawing up a wish list is a nice way to spend an evening or two, remember you are equipping your own shop, not a professional’s.

Have fun.

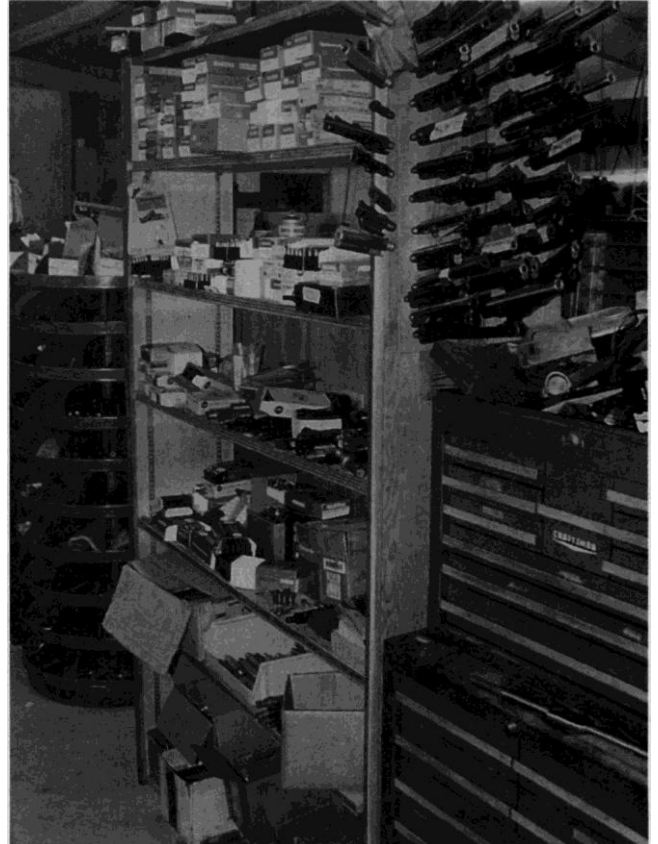


The Brownells catalog is a great read, even if you never order anything from it. If you do order, you won't be disappointed.

Chapter 2 - A Place For Everything And Everything In Its Place



Now that I've warned you against a messy work environment, I'm reluctant to show you the bench of a professional. Yes, it looks messy, but there is a clear spot in the middle where he is working.



There is no such thing as too much shelf or drawer space. You won't have to keep track of this many jobs, but you could end up needing this much space.

Just how much room are you prepared or able to devote to your pistolsmithing? While you don't need to have a full-sized shop for working on your handgun you do need a dedicated space. Struggling to assemble your handgun as you reach past the chainsaw, trying all the while not to knock the motor oil off the shelf above your head is not conducive to concentration. It can also get you hurt.

If you have to do your pistol work in the same place as the rest of your work around the house, dedicate an end of the bench exclusively to it. Keep the small engine repairs separate from the large pistol repairs.

A garage can be a great place to do your work, provided it is tight enough from the weather and heated, so the tools and chemicals will not freeze or bake. It also must be wired, so you have electricity for lights and power tools. With a large enough garage you can build a separate bench for the pistol work, away from the area devoted to lawn and garden tools and auto maintenance. Garages can, however, have security problems. Cleaning your pistol in clear view of the neighbors walking by is bad manners and the police may drop by to discuss this habit with you. This happened to one of the members of our gun club, fortunately to no bad result.



A clean and neat workbench is a must. This workbench not only has fluorescent lights in the ceiling, but a flexible lamp on the bench itself. On the left is a vise, and on the right is a bench grinder. Drawers in the back hold parts and small tools.

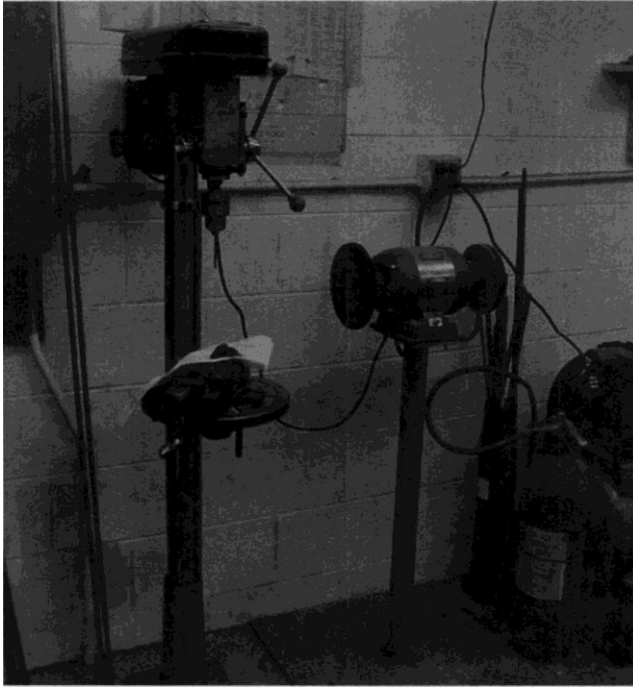
If your open garage door leaves a clear view of your workspace, then you must add completely closeable and lockable cabinets and drawers. It is also a good idea to install a screen to block outside viewing of the bench.

Basements are a big favorite. Without X-ray vision your neighbors can't just walk by and look in. A full basement will be wired for electricity, and stay warm enough in the winter and cool enough in the summer for all work. Basements with exterior entrances are not as secure as those with only interior entrances, but the exterior door can be dead-bolted and cross-barred. The main problem with basements is that they are often damp. Dampness is a disaster for your tools and parts. The quickest way to dull a file, even faster than misuse, is to let it rust. The tools you use and all the steel parts of your pistols are subject to rust. You must keep them dry. On a personal note, I find basements a bit tight as a site for work because damn few of them are high enough. At 6 feet 4-inches tall I find most basements a maze of plumbing pipes, heating ducts, and lighting fixtures that I must maneuver around or risk banging my head.

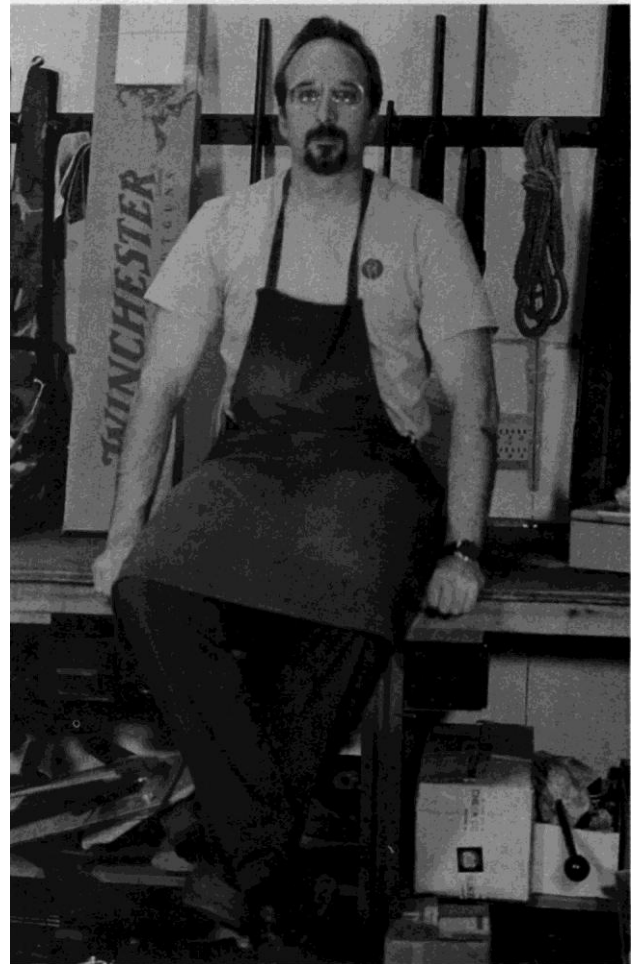
A small spare room or large closet can be used as a pistolsmithing space, without the potential poor security of a garage or the dampness of a basement. The closet may require re-wiring to get enough outlets for all of your lights and tools, and in hot weather may be a bit stuffy. I built a workroom for pistolsmithing in a small room at home that measures 5 feet by 8 feet. The bench runs away from the door the full 8 feet, with shelves above, drawers below and sufficient elbow room. It is plenty large enough for all but the most involved work. A room 8 feet by 10 feet would be spacious enough to do everything except machine work with large machines. If you have a miniature lathe or mill even those would fit into a room this size. If you do not live alone, a small room or closet may be noisy to the other occupants when you are using power tools. In this case you may have to install additional soundproofing. Ask, and they will tell you. Be sure to always wear ear protection and keep the door closed.

Once you have selected a location, what do you need there?

First, you have to have sufficient working light. Straining your eyes and struggling in the dark with your pistol can damage the pistol and hurt you. Large fluorescent fixtures over your workspace will ease the eyestrain and make your work pleasant. You cannot get too much light unless you have so many bulbs strung in the room that the heat drives you out. To avoid casting a shadow on your work, buy a flexible desk lamp. Get one with a heavy base or with a base that can be clamped to the bench. Swivel or position it to shine directly where you are working.



A drill press is nice. A power buffer is a luxury. A fire extinguisher is a must. In all three cases, bigger is better.



Your bench must be sturdy. If it can't hold 200 pounds without creaking, maybe you shouldn't put \$1,000 of guns and tools on it.

Along with the light you will need physical comfort. A bench that is too high or low, or in the wrong location is a ticket to torture. A work chair that doesn't offer back support or is uncomfortable will give you leg cramps or a backache in short order.

How high should your bench be? It depends on your height and your reach. If you are starting from scratch try a simple disassembly and reassembly of your pistol on different benches, tables or counters in your house. You will quickly find out which ones are the wrong height. If you are working with a bench already installed and find it is too high, make shallow boxes to stand on or get a higher chair and sit down. A low bench can be useable if you work from a low chair.

Of course you may not need a bench at all. One shooter I know used to have a sumo-like physique. His comfortable working position was in a recliner, his magnifying work hood on, and the parts resting on his belly. He could do his work for long periods of time this way, provided he didn't need to use a vise. While I would make a very skinny sumo, I have occasionally done some work on my lap. Only because I had to at that moment, not by choice. Barring such a large and stable belly, you must have a bench and it must be solid. When starting from scratch the best way to make sure your bench will be solid enough is to make it out of 2X4's with 4X4 legs, and a plywood top at least 5/8-inch thick. You can test the solidity of an existing bench by sitting on it. If you can't climb up on it and sit down without creaks and groans (the bench, not you) then it needs reinforcing. An extra support leg in the center, with an extra layer of plywood laminated to the top will stiffen up even a wobbly bench. Add diagonal bracing to a bench that doesn't have any. In order to keep the bench from walking around the room with you secure it to the wall. This way, if you are wrestling with a particularly recalcitrant part, you won't be wrestling with the bench too. If bolting the bench to the wall isn't an option, then bricks, sandbags or bags of lead shot on a lower shelf will keep the bench from moving. If all you do is pistol work 200 pounds should be enough.

If the prospect of constructing a bench from scratch is more than you care to contemplate, kits are available. Efficient Machinery Co. in Bellevue, Wash, makes benches originally intended for reloading that double as fine work benches. If you order one you will be greeted with the phrase "some assembly required", as they are shipped disassembled.



One thing all professional shops have in common, it is that they have many shelves, drawers, benches and cabinets.

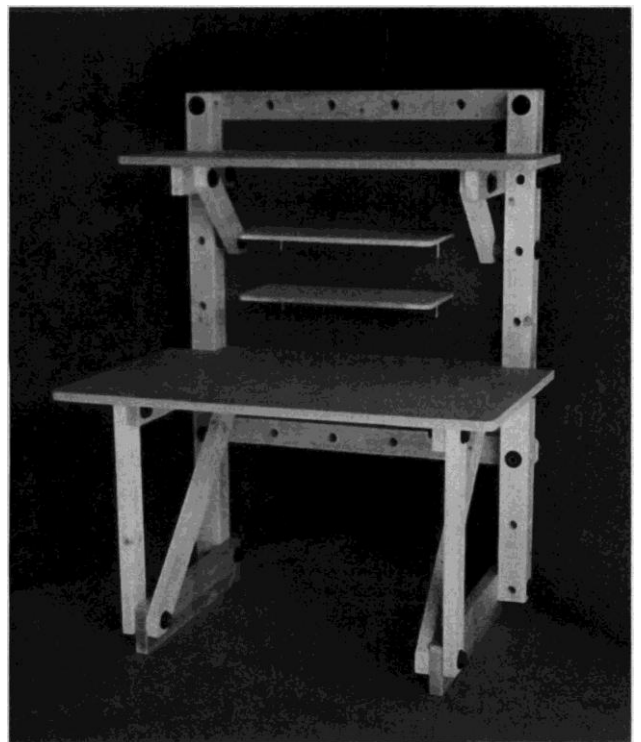
The benches are available in three heights, 33-inches, 36.5 or 41-inches, and in two sizes of table-top.

With a well-lit workspace and well-placed bench you now need to turn an eye towards organizing your tools.

Simply tossing your tools into a pile on top of the bench is messy and a good way to damage them. Do not do this. The five places to put your tools are shelves, cabinets, racks, drawers and toolboxes.

Shelves are easy to make and easy to install. If you don't mind taking a step or two when you need something the shelves don't even have to be right over your bench. If you do install shelves right over the bench, store objects on those shelves that cannot be damaged by falling, and can't damage anything if they fall. Light, non-fragile things such as masking tape, instructions for your tools, packets of steel wool, cleaning patches and cleaning rods, and other stuff. Seal your epoxy, solder, cold blue, cleaning solvents and other chemicals in individual plastic bags to keep leakage from making a mess, and put them up there too. Shelves under the bench are the place for heavy objects. This way you cannot drop a heavy object onto yourself or a valuable firearm while trying to put something on an overhead shelf. The weight also acts to stabilize the bench. Shelves do not offer any security, they cannot be locked and objects on shelves will gather dust. Put a hook on your shelves where you can hang your cleaning apron after you take it off.

If you can obtain cabinets they will offer more secure storage of your tools and parts. Just remember that cabinets are designed for dishes and cooking utensils. If you overload them they will fall apart or off the wall. If you are using salvaged cabinets, study the design to see if you can reinforce them to hold more weight. I once pulled a set of cabinets away from the wall storing nothing more in them than handguns. A standard-sized kitchen cabinet can hold two dozen pistols, and this is more weight than it was designed for.



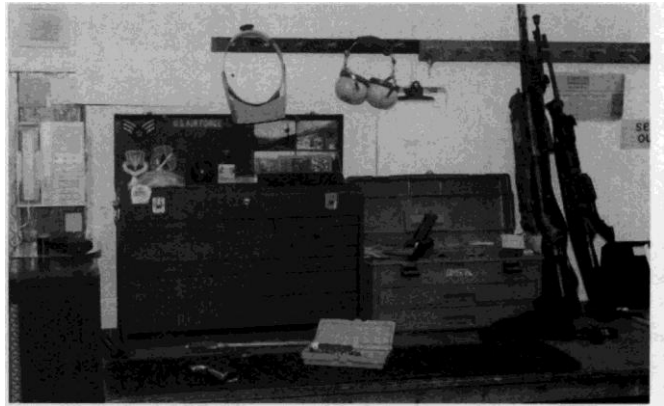
Efficient Machinery Co. makes a modular workbench that can be a portable unit, or a starter bench, (photo courtesy Efficient Machinery Co.)



A small set of shelves are handy for holding tools, parts, fixtures and the occasional handgun in process.



When you store your solvents and lubricants, place them in a plastic bag. Otherwise, the inevitable leaks will ooze and drip some place undesirable.



You must store your tools where they are out of the way, organized and ready. The Kennedy box on the left runs \$500, the plastic one on the right is \$50. Both get the job done.

If your bench is large or deep enough, store the tools used frequently in racks on the bench top.

Place the screwdrivers and drift pins here, where they are out of the way but easy to reach. A rack at the back of the bench can hold the hammers.

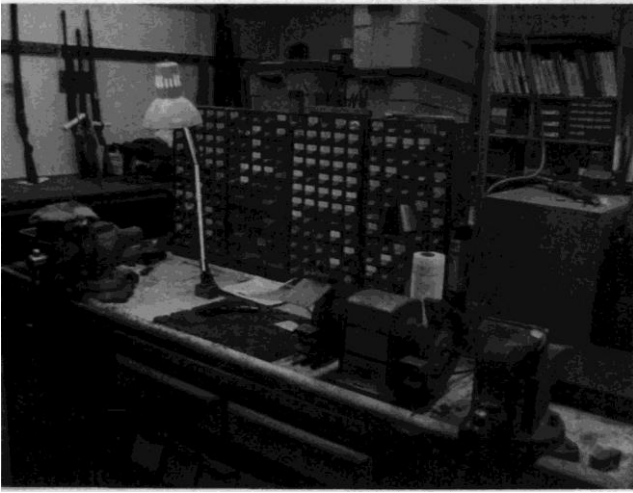
Objects that need protection go into the drawers. Here are the files, the dial calipers, a micrometer if you have one, and any fixtures for fitting or cutting parts. Taps and dies should also be offered the protection of drawers and not left on the bench. If your bench isn't large enough to keep the punches and hammers out on top, keep them in drawers separate from the delicate things.

If building cabinets or drawers sounds like work that will keep you from pistolsmithing, go to your local tool warehouse store. There you can find toolboxes of the kind mechanics use, and for a lot less money than they pay.

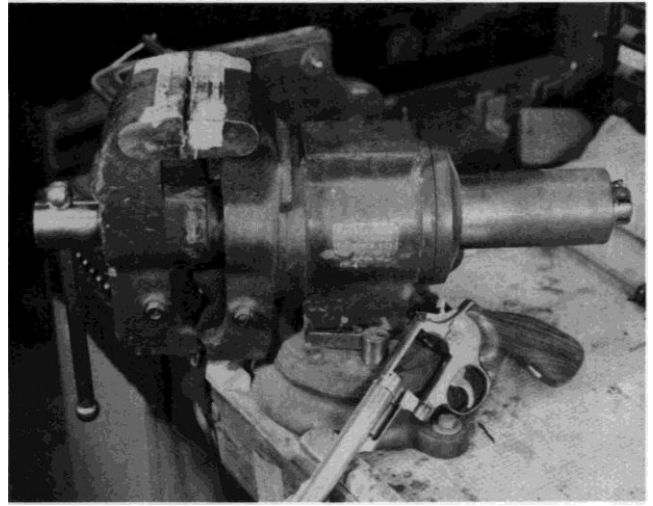
When you aren't using a tool, put it back where it belongs. Dumping all of your files into a drawer may keep them out of sight, but it is a good way to nick and dull them, too. The digital dial calipers you paid \$150 for will last a whole lot longer if you don't leave them out on the bench where the ball-peen hammer can be laid on them.

The finest bench in the world is not sufficient by itself. You need tools to work with, and only the right ones will do.

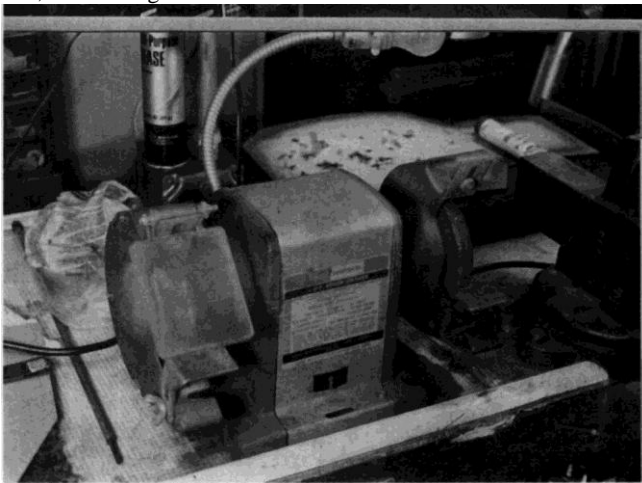
Central to your use, but not always centered on the bench, is your vise. A vise is your third hand, holding objects so you can see them, work on them, assemble them. Buying a vise smaller than you need is false economy. It will not securely hold large parts no matter how firmly you tighten the handle. A large vise, however, can hold small parts provided it's precisely fitted. For pistol work you need a vise with jaws at least 5 inches wide and an opening of not less than 4-1/2 inches. While bigger is better, there is a limit. Don't go out and buy a vise large enough to hold an engine block just to show off to your shooting buddies. Such a vise may break both your wallet and your bench.



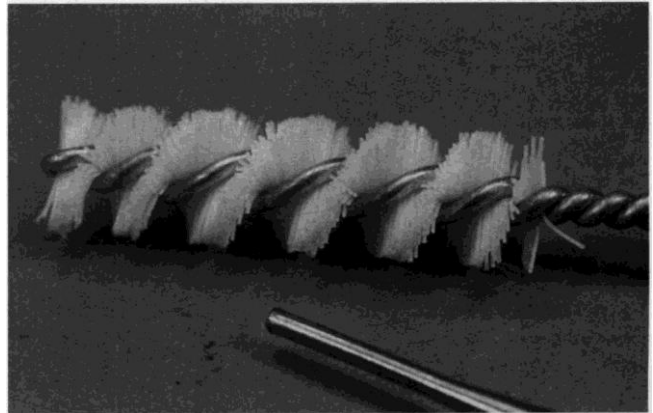
This bench has the luxury of two vises. There are also drawers under the bench, to hold larger and heavier items.



A solid vise is a must. This vise is over twenty years old and works as well today as the day it was bolted to this bench.



A bench grinder is useful, noisy and dirty. Do not get a little one, it will disappoint you.



You'll need cleaning brushes. Some handguns come with a brush. This one from Glock has plastic bristles and will last quite a long time.

Before you attach the vise to your bench you'll need to find the best spot for it. Place it on the bench and pretend you are working on a part. Can you get to the part from every angle? Position your light and look at the part. Are you working in your own shadow? Move the vise from time to time to check a new location. Find what works for you. I need at least 3 feet between my vise and the wall for my comfort. This distance will be different for you. Make it comfortable. Then pull out your drill to install the vise bolts.

Should you have a bench grinder? A bench grinder allows you to sharpen or alter tools, modify parts, and remove stock fairly quickly. It is also noisy and dirty. It can get you in trouble. With too heavy a hand, you can take off much more metal than you intended. You can overheat a part and draw the temper from it. You can burn yourself. I have seen people using a bench grinder lose hold of the part they were grinding and launch it across the room.

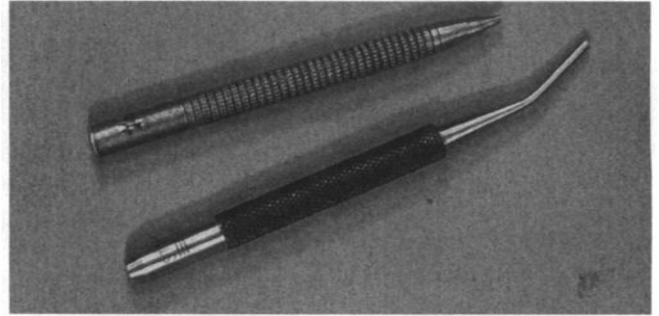
For many things however, such as quickly grinding down the frame of a pistol to fit a beavertail grip safety, a bench grinder is just the ticket to save you several evenings of filing by hand.

If you decide you must have a bench grinder, get one with a one-quarter horsepower or larger motor and at least a 6-inch wheel diameter. More horsepower means you are less likely to slow down the grinder by pressing a part against the wheel. Large wheels give you a larger surface area for wear of the wheel, and a larger ground surface on the part. A larger bench grinder does cost more, and requires more electricity than a smaller one, but is worth it. My grinder, a one-half horsepower Sears grinder with six-inch wheels is still running smoothly nearly 20 years after I bought it used. If the noise and the mess are too much in the house or basement, then banish the bench grinder to the garage. It will do fine out there.

Most of the hand tools you will need for your work are simple and common. A few are somewhat specialized.



A good set of screwdrivers such as these from Dillon are a must-have item.



You will eventually bend a drift punch. Use your bench grinder to cut the bent shaft off and turn the punch into a tapered punch, so you won't bend it the next time.

You'll need several types of hammers. Most important is the ball peen hammer. The ball peen hammer is alloyed and tempered for the job of banging against metal. The more common claw hammer is not. Use the claw hammer for peening and it is likely to suffer damage from repeated use. You could even injure yourself. Hammers are not so expensive that you need to be cheap about this. Buy a 12 ounce ball-peen. Yes, a heavier hammer can strike a harder blow, but you will become tired using it and make more errors. You definitely don't want to peen the wrong spot on a part, or your thumb.

Next buy yourself a plastic and rubber mallet. This has one face made of a tough plastic, while the other is softer rubber. Be sure and get one with replaceable faces. With some jobs such as lapping a slide onto a 1911 frame you may end up chewing the plastic end to bits after a few slides. Replacing the face is cheaper than buying a new hammer. You'll use the rubber end when you want to tap something on or off without leaving marks.

Some pistolsmiths use a smaller hammer than the 12 ounce ball peen or the large plastic mallet, but I only keep small hammers in my emergency tool kit. The larger hammer on my bench will do all the work of a smaller one. The only advantage of the smaller hammer is less weight to lug around in your shooting bag.

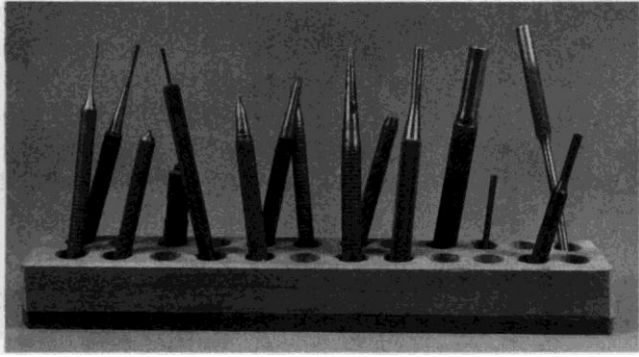
The screws used in firearms are traditionally different from the screws found around the house, and need slightly different screwdrivers. Pick up one of your screwdrivers and take a close look at the tip. A standard screwdriver has a tip that is ground with the flats at a slight angle to each other. In a cross-section it looks wedge-shaped. This angle of the blade lets the tip fit into the slot of a screw regardless of the slot's tolerances. Use such a screwdriver in the screws on your pistol and you will round the corners of the slot. Not only is this unsightly it is also the obvious mark of an amateur. The tip on the standard screwdriver is tempered to be softer than you need. The softness keeps the tip from breaking. When working on firearms we would rather break the tip of the screwdriver than mar the screw slot.

Firearms screwdrivers have a hard tip, ground so the flats are parallel. The screws on firearms come in a much larger variety of slot sizes than common screws do. In order to properly fit a screwdriver to each screw you will encounter, you either have to have dozens of screwdrivers, or be willing to modify the ones you have. Professionals do both. At last count, my drawers and shelves held 47 screwdrivers, not counting the overflow drawer that holds the "to be modified" screwdrivers. A good way to start is to buy one of the replacement tip screwdriver sets. The hollow shaft is magnetized and will hold the tips in place until you pull them out to replace them. If you have to modify one of them, a new tip is cheap to buy.

You won't need much in the way of pliers. When reassembling after cleaning, a narrow needle-nose pliers can be handy.

Buy a bushing wrench for your 1911, so you can remove tight fitting bushings. In the 1911 chapter I'll show you how to fit a bushing so it is accurate and still removable with your fingers. As for other wrenches, I haven't found a use for them in pistol work.

A constant companion at the bench will be a top-quality calipers. Either dial or digital, you will use it almost all the time. When fitting parts calipers tell you how much metal you have removed and how much more you have to go. In the professional's shop, the dial or digital calipers are used a hundred times a day. You can spend as little as \$30 for the dial type, and \$120 for the digital type. Take care of it, keep it clean and stored safely, or you may be buying a new one too soon.



A small block with holes drilled through it will organize your punches. Make another one for your files.



Safes are comforting, heavy and expensive. If you can get a safe into your home, great. If not, then make sure your guns and workspace are in a locked room.



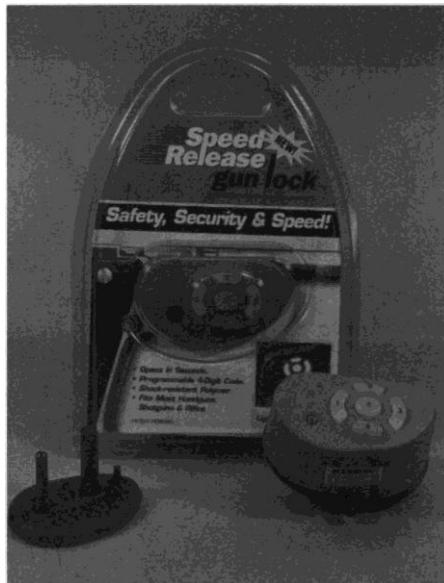
You may also want to consider a gun lock, even if your handguns are in a safe or locked cabinet.

Buy two types of punches, steel and brass. The brass ones are for drifting sights, or pressing parts together when you don't want to leave a mark. A quarter-inch rod long enough to hold onto without hitting your hand with the hammer works well. Even though it is brass you still have to be careful. Too heavy a blow with the hammer will leave a mark on a soft steel part from the brass rod. Some pistolsmiths prefer nylon to avoid this, but I have found nylon flexes just a bit, and makes removing tightly-bound sights tougher. Use steel drift punches to remove pins that hold assemblies together, like the safety on a Beretta M-92 or the ejector on a 1911. If you plan to do a lot of work on a pistol with roll pins, and you don't want to mar the pins, buy drift punches specifically for roll pins. The steel punches come in sets or individually. A good basic set is the Brownells Gunsmith Professional punch set. This contains 10 punches: a selection of drift punches, a center punch and a staking punch. It covers most everything you'll need. Or measure the pins on your handguns with your calipers and then trek off to the tool store to pick up just the sizes you need. Of course you'll have to do it again for the next handgun, and the next.....

With the workspace finished and stocked, you now have to secure it. Back in the really "old days" shooters left their firearms in glass-fronted display cases, for their friends to admire. Now, the consideration of many shooters is "a safe, or not?" If you have a specific room that is used for nothing but your pistol work, then putting a deadbolt lock on the door is a good idea. If you have a part of the garage or basement devoted to your work that is not separate from the rest of that space, the best approach is to build or install cabinets above and drawers below that can all be locked. When you are done and clean up your workbench (and you will clean up, right?) there is nothing to be seen as "gun stuff." The pistols themselves can either go into locked cabinets or into a small gun safe. For extra security, put gun locks on each of your handguns. Rather than trying to keep track of a large ring of keys, use the Speed Release brand gun lock. It uses lighted buttons that you press in the correct combination. If someone tries several incorrect entries the lock shuts down and won't respond until it has waited long enough.

If you built your bench into the corner or end of the basement, you can install french doors to block the view of visitors to your basement. Make sure the safe is hidden by the doors, too. I am not saying that your neighbors are waiting to descend upon you and strip the house of everything of value, but people talk. And by the time the fourth or fifth person down the conversational line has heard about your "walk-in vault full of guns and cameras," they may not be so law-abiding.

Security is not just a matter of keeping guns out of the hands of kids or thieves. What if you don't secure your work room, and out of curiosity a party guest who has wandered off turns on your lathe? If your luck is good, they will only turn it on. If your luck is bad, their tie will get sucked up by the chuck, and the next thing they know their face is being hit by the edges of the chuck at 400 rpm. Lock the cabinets and drawers, use a master power switch, and lock the door!



Available in one designer color, safety orange, the Speed Release gun lock does not use keys. You punch in a code number and the unit unlocks. If someone tries the wrong number a few times, the unit turns off for a few minutes, then turns on again.

All these tools, and the handguns themselves need protection from moisture. If you lock everything up in a closet, cabinets or a gun safe, you may be locking moisture in there with them. Invest in a canister of desiccant. The desiccant sucks moisture from the air, protecting your guns and tools. When it has had its fill, bake it in your oven to dry it out and start again.

As a last item, you may want to talk to your insurance agent about the coverage for your tools. It would be a shame to spend a chunk of money and have a ball learning to do your own pistolsmithing, only to find out that the insurance company won't replace the tools when your basement floods.



Moisture tarnishes and rusts metal. A desiccant in the safe or cabinet can protect your valuable tools and handguns. Handled carefully it will serve as a protectant for years.

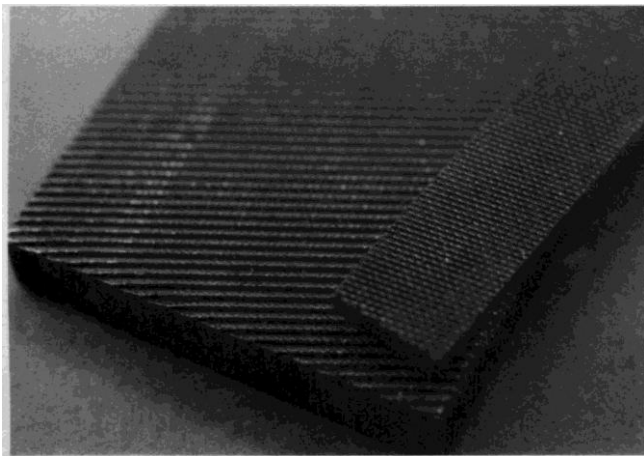
Chapter 3 - Files and Stones and Mills, Oh My

Just as pencils have erasers to remove excess letters and words, so the pistolsmith must have something to remove excess metal. The bench grinder or mill are your large erasers. Using power you can remove large amounts of metal readily, or small amounts quickly. Files, stones and emery cloth are your small erasers for fitting parts, smoothing engagement surfaces or polishing. They can be found in every shop in the country.

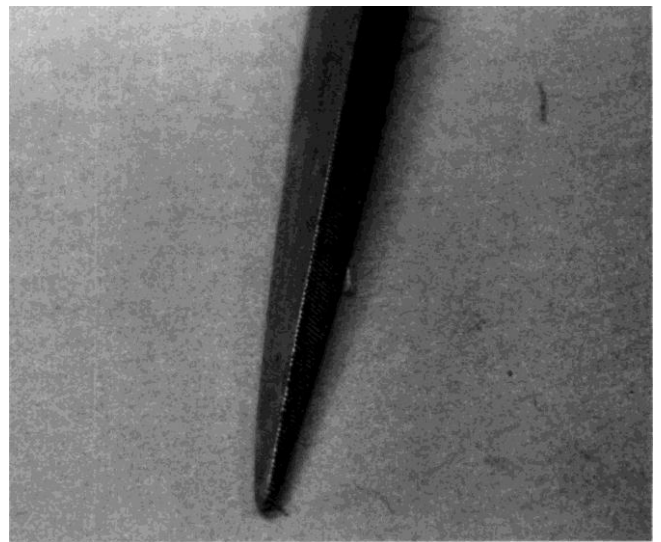
If you have these hand tools at home, they are likely to be the common household variety. The file is coarse and usually rusty. The sandpaper is rough and made for sanding wood. Most stones I have seen around friends' houses are worn, uneven and clogged with gunk.

Files for your handguns are much finer than the files for sharpening the lawn-mower blade. Pistolsmithing files are precision tools. At a bare minimum you will need two large files, one medium file and a set of small ones. First, purchase an extra narrow pillar file in the Swiss #2 cut. This file, 8-inches long and just over a quarter-inch wide, is narrow enough to maneuver into and around your work, large enough to hold comfortably, and cuts smoothly enough that with the right touch will produce a finished surface. If you cannot find them at a tool store in your home town, Brownells carries them. I have used so many and been so pleased with each of them that I refer to it as "the perfect file". It does have a drawback, and that is its flexibility. It will bend while you work with it and you have to watch out for rounding your cut surface because of this file flex.

While you could limit yourself to "the perfect file", why should you? For your other large file get an American 10-inch 2nd Cut file. The Swiss don't make one the size and cut you need. The teeth are coarser than the #2 Swiss, and the file is wider, longer and stiffer than the pillar file. All these features let you remove stock faster than the pillar file. When you are making large cuts you want a big file so you can keep your cut surface flat. If you use a small file to level a large area, you will have to work harder to keep "bite marks" out of your work. These are unsightly creases where the edge of the small file has cut into your surface. The 10-inch 2nd Cut file lets you blend the compensator body to the slide on your pistol, or carefully square the face of a revolver frame when you re-barrel it.



The tips of two files. On top is the extra narrow #2 Swiss pillar file. Underneath is a 10-inch American Second Cut.



A three-sided file with one edge safe. The file teeth have been ground off on one side, so you can file with only one side if you want to.

For your medium file purchase a 6-inch tapered, triangular file in either the American Smooth or Swiss #2. It is important to get one with a safe edge (that is one face without cutting teeth). If you cannot find one with a safe edge, then the first use of your bench grinder will be removing the teeth from one face of the file. Use a light touch and many passes, to minimize heat buildup, and keep the ground face level. Excessive heat will draw the hardness out of the file. Later you will use the triangular file to fit certain rear and front sights. The tip will get into places the larger files can't.

Purchase your needle file set in a fine cut. These files—flat, round, half-round, triangular and beveled—are perfect for reaching into small areas. Also use them for light work when you simply can't cut past the needed depth.

Buy a file card and file chalk, you will need them as soon as you start filing.

Files have been referred to as “hand-held mills” for good reason. You can remove impressive amounts of metal with the right file, even when the file isn't specialized. The right file can also save time. And they are fun to use. A professional pistolsmith often has drawers full of files for all these reasons.

The pistolsmith from whom I learned the trade had to make his own compensators from bar stock. After boring them on the lathe, threading and fitting them to a slide, he would file them down from their rectangular profile to the slide profile. For the first hour of filing he used a 12-inch American Bastard cut file. Very coarse, this file can remove large amounts of metal relatively quickly. With the heavy work done, he'd switch to finer files. Compensators are now available already profiled, and today there is no reason to make a comp from a rectangular block. You probably won't need a 12-inch Bastard cut file, but if you really want one they cost about \$15. Go ahead and splurge.

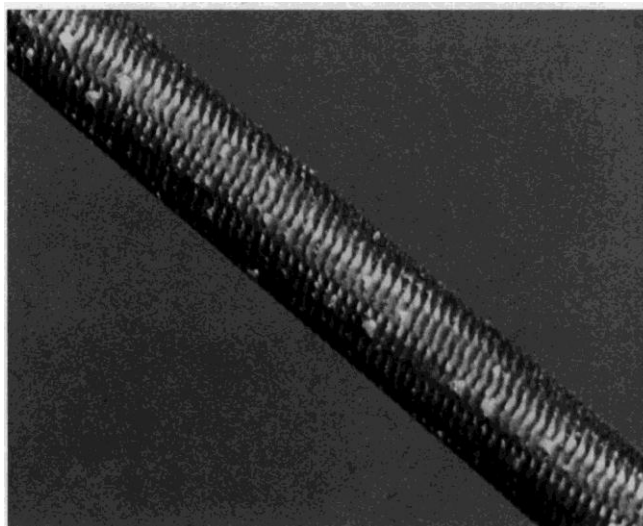
Specialized jobs require specialized files. For example, some hammers on the 1911 are so rough that you need to use a hammer hook squaring file even before you start using stones. When you fit a barrel to your 1911, a barrel lug file is the only one that will fit in the locking lug slot. Both of these files are absolutely square on cross-section, with two opposing faces as cutting edges. The other two edges are “safe”. Another specialized file for 1911 barrel fitting is the bottom lug file, a circular file .200-inches in diameter. This is the diameter of the slide stop pin, not an even fraction of an inch.

For some reason, the rear sight dovetail on the 1911 has traditionally been 65°. There is a specialized file for this, a safe-edge 65° file. The regular three-sided file cuts at an angle of 60°. In an emergency you could fit a 1911 rear sight with a three-sided file, but do yourself a favor and spend the twelve bucks for the proper file and save yourself the work.

Back in junior high shop class my teacher Mr. Braisted had a collection of photographs of mistakes in shop procedures, and the results. The one that sticks on my memory is of the fellow who had been filing on the lathe without a file handle. The large, color glossy photo was of him standing in the infirmary with the tang of a 10-inch bastard file sticking through his hand. Put a handle on all of your files! Even if you are not using your files on a lathe, handles will be more comfortable and give you more control.

You will have to make even more specialized files yourself. For example, I have yet to find in a catalog just the right file for adjusting the extractor ratchet when timing the double-action trigger pull of a Smith and Wesson revolver. If anyone makes this file, other than Smith & Wesson, I didn't see one when I needed mine, so I made it. For this you will have to take one of your needle files and modify it with the bench grinder. Select the tapered one with a cutting face and a safe-edge back. Grind the left side of the cutting edge down until the file is a narrow strip. Grind the back to thin the file just enough to fit between the ratchet teeth on the extractor star. This file will let you file just the right spot on the ratchet to time your cylinder.

As important as selecting the right file is knowing the correct method of using it or any file. Pick up your file and look at the teeth. You will see a series of serrated lines, pitched towards the front of the file. These are what cut the metal. A file cuts only on the forward stroke, and dragging it backwards over the work will only prematurely dull it. Some of the metal you file falls off of the file, other bits remain in the file teeth.



This file has many pins in it, and needs to be cleaned. This is caused by not using file chalk.

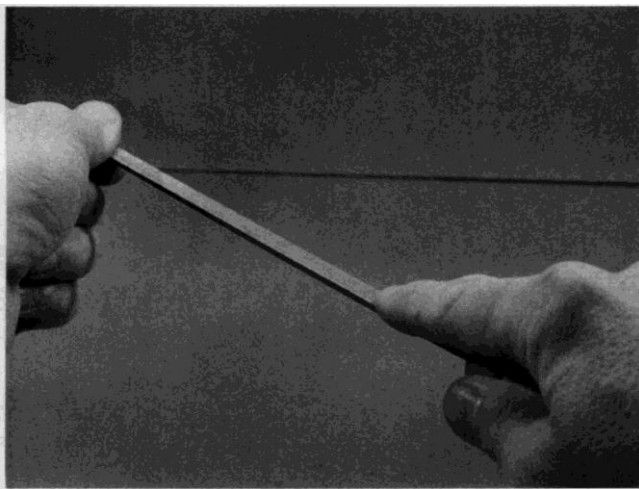
When a row of teeth are full of metal that row will not cut any more. You can feel this. The file will seem to float across the work surface, and only bite when you reach the end of the loaded section. Most of these filings will simply fall out if you tap the file against a hard object, or wipe it against your shop apron. There are filings, however, that will not fall out. If you do not remove these bits of metal (called “pins”) they will mar your work, gouging the surface as they are dragged along in the file. This is where your file card comes in. A file card is a brass brush with very short and stiff bristles. With it, you can brush, or “card” the collected metal out of the file teeth.

File chalk is a soft white talc-like material. Apply it by rubbing the file over the block as if you were filing the chalk. Liberal use of file chalk makes the metal filings easier to remove and reduces the number of pins you have to pry out. It extends the life of the file, reduces pinning, and—darn—gets all over the place. Filing is messy if done right. Be sure to clean up afterwards or you will be tracking filings and chalk all over the house.

The last addition to your file drawer is a chemical solution by the name of Dykem. A dye in an evaporative base, Dykem coats metal and dries like a very thin paint. When you have coated a part, any work you do shows through the dye. You can see right where you are filing. A small bottle should last years if you keep it tightly closed. In large machine shops Dykem and its competitors are used in aerosol cans. You don't need this much, unless you really want the part, the vise jaws, part of the bench, and maybe even your hands to be a nice, even, dark blue.

Now you are ready to file. Apply Dykem to the area of the part you will be filing. Secure it in your vise. Take your clean file and chalk it. Grasp the file by the handle and its tip. This gives you the maximum control over the depth and direction of the cut. Place the file against the working surface, check the angle to make sure it is correct, and press the file down and forward. At the end of the stroke, pick the file up and start over.

Check the file and your cut surface regularly. At the first sign of a pin on your file, stop, clean and re-chalk the file. To check your filed surface, remove the part from the vise. Examine the Dykem coating. Are you filing the correct spot? Check the angle. Does it look right? More importantly, does it fit right? Check the fit every couple of passes. Files are great for removing metal, but very bad at putting metal back. File off too much and you'll be visiting the welder.



This is how you hold a file for power and control.



You will need stones for polishing and fitting. The best are ceramic stones. The Brownells hammer/sear stone kit is also useful as a general-purpose set of stones.

Cutting finer than even the finest file, stones have been used even before there were pistols to “smith”. My oldest reference books all mention using stones to work on parts for fitting and smooth functioning. In the old days stones were just that, chunks of rock carved out of a mountain, graded as to their grit and hardness, and more or less ground to the shape you needed. You've probably read about them: the finest stones were expensive and fragile. They had to be stored soaked to keep them from becoming brittle. They had to be used with lots of oil, the oil acting to keep the stoned-off particles of steel from clogging the pores of the stone. If you wanted stones that were square you had to grind them flat on a piece of glass using grinding compound. If you didn't grind them, the corners of your stone would be round, and the edge of your cut round, too. You can't imagine the aggravation of trying to do a proper trigger job with a newly ground stone only to find that you had hit a soft and crumbly spot on the edge, and either had to re-grind another edge, or get another stone. Even a few years back we still used India and Arkansas stones soaked in honing oil because that was all there was. They were a great, messy, painful, hassle and we are all glad to be done with it.

Now, you can buy synthetic stones that not only are more consistent, but come ground square. As an additional bonus, the synthetic stones use water as a lubricant, and clean up with soap and water. Buy synthetic and don't look back. Trust me, no one uses the old stones anymore if they have any choice at all. Having said all that, it is my sad duty to tell you that you can't get synthetic stones in all the sizes and shapes you might need.

You don't need stones in all cutting grades because you don't need a stone that cuts any coarser than the finest file you own. This means you need stones only in medium-fine and extra-fine grade. The Brownells ceramic stones are color-coded: the medium-fine is black, the extra-fine is white. They are large stones, 6-inches long by half an inch square. While intended for trigger work, they make great general-use stones as well. You must keep separate stones for trigger work and general work. Otherwise you will be regularly grinding new corners on your stones for trigger work, because the general work has rounded them off.

For smaller sizes and other shapes, Brownells and Spyderco both make a set of smaller synthetic stones. Triangular, round and square, these are great for getting into areas that the larger stones won't reach.

Stoning and filing are different processes. In a file, the teeth cut small pieces off the surface. These filings can be brushed out of the file teeth. A stone abrades the metal off, in much smaller pieces. These pieces fill the pores of the stone, and have to be washed out. Stoning is done with two hands whenever possible. On a large stone you hold the ends, on a smaller one or in cramped work you get both hands on the back end of the stone. Lubricate the stone, and work it smoothly and evenly across the work surface. Unlike files, stones cut in both directions. Some pistolsmiths will not use a stone back and forth because the motion tends to round the cut. By only pushing the stone they keep the cut level. If you are using a stoning fixture you can't round the cut. The problem is that only a few specialized jobs lend themselves to using a fixture.

To stone, Dykem the area you will stone. Firmly secure the part in your vise. Take a clean stone and lubricate it. With a hand at each end if possible, or both at the back end if that is all you can do, gently rub the stone across the surface a few times. Check the part to make sure you are stoning on the correct spot, and at the correct angle. Check the fit of the part. Once you have the location and angle of your stoning established, press harder on the next set of passes. Continue until the stone is too loaded to work with, or you have finished the job. As you use stones you'll find they get loaded up with stoned off metal faster than a file, and are harder to clean.

With a synthetic stone, a basin of soapy water at hand lets you clean the stone easily. Dip your fingertips in the soapy water, and rub the stone surface to remove the filings. Swish the stone in the water and rub again until the metal is gone, then rinse with clear water and continue stoning. When you are done a synthetic stone needs to be cleaned and dried before being put away.

For natural stones, you have to use more of the honing oil. You need a basin of oil, and a small brush to scrub the stone instead of your fingertips. Once it is clean, re-oil with the honing oil and get back to work. The natural stones should be cleaned and left oiled. Place them in the plastic tubes they were shipped in and label each tube for future reference.

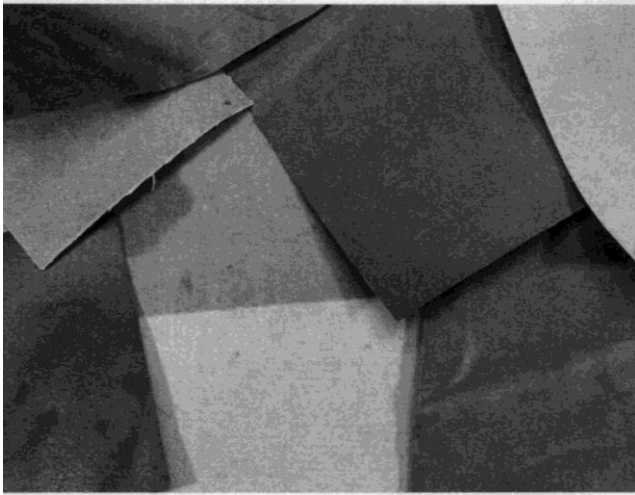
Polishing, the process of creating a uniform and desired surface texture, can be cosmetic or functional. In polishing you do not remove or reshape metal the way you do in grinding. Instead, you create a smooth and consistent surface texture. Well, that's what you should be doing. If you actually intend to remove metal or change contours, polishing is an inefficient way to go about it. And if you aren't planning on major metal reshaping, you can still make a lot of trouble for yourself if you lose track of what you're doing, say by using the wrong grit or pressing too hard. Correct polishing requires a careful and attentive touch.

Examples of bad "polishing" are everywhere. 1911's often have their original sights removed. The front or rear of the slide then gets welded up and "polished" down. Some shooters think coarse emery cloth, used without any lubricant, and with a heavy shoe-shine motion, is just the ticket for dressing down that weld. Not only does this method produce an unsightly repair, it also turns the straight line between the sides and top of the slide into a wavy mess.

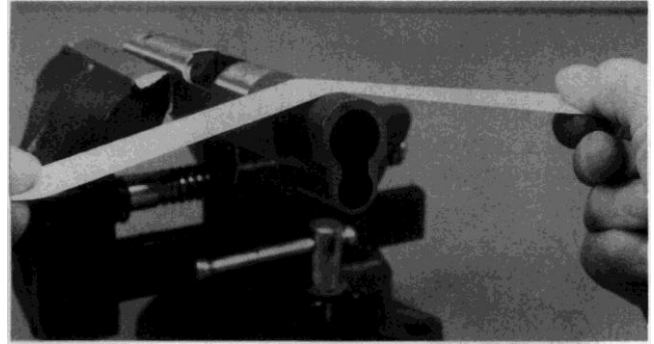
Do not ever "polish" this way.

For polishing larger areas, or blending surface finishes, emery cloth is just the ticket. While there is some overlap in the grit ranges of carpentry, cabinet-making, and pistolsmithing, you should buy paper or cloth-backed abrasives intended for use on metals, and rated for wet sanding.

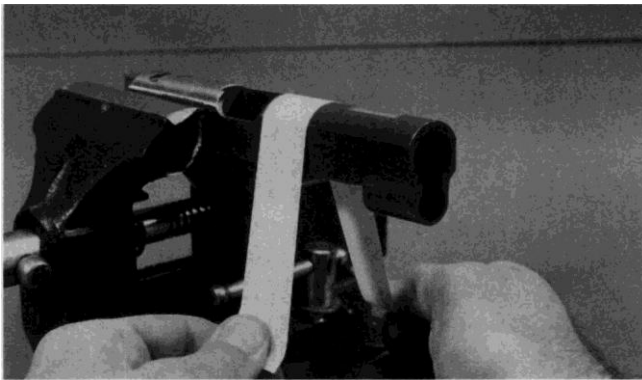
I buy my cloth in two types, rolls and sheets. E-Z Flex Metalite cloth comes in rolls, cloth can be torn to the length and width you need, and with a little mineral spirits as a lubricant can polish rounded surfaces easily. If you want to polish a flat surface, use an old file as a backer or lay the cloth on a hard flat surface and draw the part across it. Rolls are available in grits from 120 to 500. You'll need 600 or finer grit for a mirror finish. Buy sheets for this final polishing.



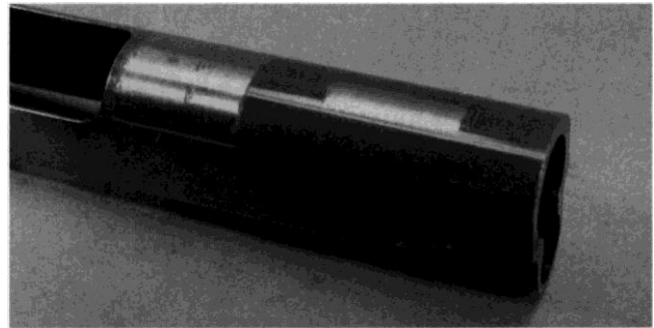
Abrasive cloth comes in a wide variety of paper and cloth sizes, and abrasive grits.



Holding the abrasive cloth taut limits the area sanded to a small part of the curve.



Holding the cloth down on the sides sands the entire radius of this slide.



You can see the difference in the amount of area sanded.

Composition of the grit is not a big deal. I have tried both Aluminum Oxide and Silicon Carbide, and do not see any difference between them.

Dry sanding is not very useful in firearms. Firearm steel is so hard that you will quickly rub the grit off the cloth or paper, leaving an expensive bit of rag. Use only cloth or paper intended for wet sanding, or “wet and dry” grades. Wetting the cloth or paper with mineral spirits extends its life. (In the interests of not having to type “cloth and paper” the next hundred times, please understand that from here on I am referring to both when I use “cloth”, and talking specifically of paper when I use “paper.”) The mineral spirits and the rubbed-off grit form an abrasive slurry, which keeps cutting the steel. When you want to inspect the surface you will have to rub this slurry off. Be careful, and only use a dedicated cloth to wipe the slurry off. If you use a general cleaning cloth, and then use that cleaning cloth to rub down a firearm, you will scratch this firearm with the slurry held in the cleaning cloth.

I use mineral spirits as a solution for keeping my abrasive paper or cloth wet. Be sure to buy 100 percent pure odorless mineral spirits because the mineral spirits will get all over your hands. Odorless will cost more than the industrial mixes that have a percentage of reclaimed content, but the reclaimed mineral spirits will have a definite kerosene odor which you may find objectionable. If you do not live alone, your co-resident may also find the odor offensive. Buy the good stuff.

It can take a little extra work to find pure, odorless mineral spirits. Look in your phone book for “machine tools” or machine tool suppliers. These people provide tools to the small manufacturing shops in your town. When you call to inquire, don't be surprised if they tell you the pure mineral spirits cost \$6 or \$7 per gallon. A gallon will last you a long time, and the extra cost over the stuff that has an odor is well worth it. If your hands dry out from using the mineral spirits, a good hand lotion will put the moisture back in your skin.

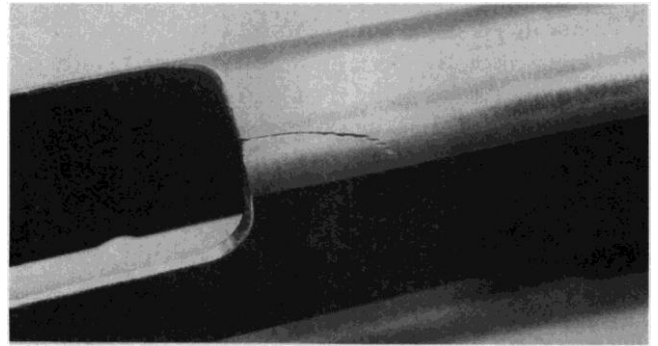
Using abrasive cloth on metal is not a mystery, but you must keep a few things in mind. You have to follow the order of the grit, going from one to the next. The coarsest cloth to use is 180 grit. It will quickly cut down a high spot on a slide or frame. You can use it to blend a welded repair, or adjust the curvature of a compensator body to match that of the slide.

The next grit, 220, is probably the best general-purpose grit. It will not cut as quickly as the 180. If you use a light touch, it will not alter angles, lines, or the edges between two surfaces. It is smooth enough that you can leave it as your final surface preparation before bluing or plating. The 220 grit delivers an even, satiny look to your surface, but with a definite grain to it. When you switch to the next-finer grade, you should work at an angle to the grain of the 220, to polish out the 220 grain. Change back to the previous angle for the next grit. If at all possible with each change of grit I work at an angle to the previous grit. This way I can easily make sure I have polished out the grain of the previous grit. The final polish grit is done in the direction I want the finish to be oriented, removing the marks from the next-to-last grit.

There are some situations where it simply isn't possible to change directions very much, or at all. Polishing a compensator is one case. Here I make use of liberal amounts of Dykem, and closely examine the surface to make sure I remove all of the previous grain. An awkward place to polish is blending the back of a frame during the installation of a something like the Ed Brown grip safety. I alternate between the hand-held grinder and the emery cloth. A light touch with the grinder and a polishing bob buffs up the high spots, letting me see the areas that need more attention from the emery cloth.



An old and still useful hand-held grinder. With some grinding stones, polishing bobs and a sanding drum or two, you can fit anything.



If you do not brace your hand when using a hand-held grinder, the stone may slip. If you are lucky, you may only mar your handgun, as in this 1911 slide.

The most versatile and arguably the most useful power tool is a Dremel or Foredom hand-held grinder. It is also the one most often blamed for problems. While the bench grinder operates at 1200 to 1800 rpm, the smaller stone or polishing bob of the handheld grinder can run at 5000. This high speed allows you to cut, grind or polish just about anything. There is a risk. It also means that if you aren't careful you will inadvertently cut, grind or polish anything else the wheel touches. The unit is so handy that it is easy to get caught up in a task and go too far. Or your hands may slip and you'll find that the grinding stone you were using to level a lowered ejection port has just ground a swooping line across the side of the slide.

With a little care you can minimize the risks and maximize the advantages of a hand-held grinder. Have the part you are working on securely fastened in your vise. Brace your hands. Wear eye and ear protection. Remember, you'll be using the grinder inches from your face and you will find it impressively loud. The grit and metal chips being thrown into the air make quite a mess. Wear a breathing mask. Stop frequently to check your work.

The wheels, or stones, for your grinder come in a bewildering variety of sizes, shapes and grits. Standard wheels of silicon carbide work for most every application. The regular wheels vary from 1/4-inch to 1-1/4-inches in diameter, and come in wheel, barrel, cone and ball shapes. They will wear down as you use them. After a few uses you'll have a larger choice of diameters for later work. You may want to get a special tapered stone for use on 1911 slides. Buy one made of Aluminum Oxide impregnated with Cobalt, the tapered shape cuts that flare at the back of the ejection port some shooter love. Other compositions are available in the tapered shape, but they will not last as long against the hard steel of the 1911 slide. You will spend more time polishing the flare. If you want the flare, buy this stone.

Next get a sanding drum. A sanding drum starts life as a standard grinding shaft with a shoulder attached to it. Pressed over the end of the shaft to the shoulder is a rubber cylinder, called a drum. The sanding sleeve passes over the drum. When you tighten the screw on the top, the drum is squeezed and bulges out, holding the sanding sleeve in place. I find the sanding drum particularly useful when fitting the Ed Brown grip safety onto a 1911. This safety requires a great deal of blending of the frame and safety. The sanding drum speeds up this blending.

Unlike grinding stones, the sanding drum does not change its diameter as you use it. Instead of wearing down, it wears out and becomes duller and duller. When the sleeve becomes too dull to be of any use, take it off and replace it. Sometimes you can get more life out of a sleeve. If your drum is slightly oval, one part of the sleeve will wear out faster. Loosen the screw, rotate the sleeve and retighten. You will have a new or newer surface on the cutting face of the drum.

You'll also need Cratex polishing bobs. These rubber tips are impregnated with a grinding compound. I use only the fine and extra-fine bobs for polishing. Cratex makes a kit of all the various sizes and shapes, in all four grits. While convenient, I prefer to buy only the points I need. I also buy extra shafts. Once you have a bob installed, and ground to the size you want, leave it on that shaft. If you need another polishing bob, rather than switching from your one-and-only shaft you simply set up another bob on a shaft.

Pistolsmithing sometimes requires small work on hardened steel parts. For these applications you'll need solid-carbide cutters. Carbide cutters retain their shape. Stones do not. If you start with a small stone for a small job, the stone can wear completely away before the job is done. Carbide won't do this. Carbide can cut even the hardest steel if you are willing to be patient about it. If you are impatient you'll overheat your cutter, burning and dulling it.

I have found that using a carbide cutter on steel creates the most curious metal flakes. They aren't filings and they are magnetized. If you make the mistake of trying to wipe them away with your hand you will have these annoying little shavings stuck in the skin of your fingertips for a couple of days until they work their way out. Instead, after cutting with carbide, take the part to your wastebasket and give it a shot from one of the aerosol gun cleaners. If you have had to do a lot of cutting and the shavings are really balled up you may have to give the part several of these shots. Don't use your fingers.

To complete your hand-held grinder ensemble get a set of cut-off wheels. You can use them to make saw-like cuts into even the hardest metals. If you are removing the hammer spur from your revolver use a cut-off wheel. While you can grind the spur off, doing so creates a lot of heat that can draw the temper out of your hammer. With the cut-off wheel you put the hammer in the vise. The mass of the vise draws off the heat, protecting your hammer as you make your cuts. Make sure you wear some sort of mask when using a cut-off wheel, as the dust it creates is particularly fine. You DO NOT want to inhale this stuff.



The author, getting ready to do some grinding. Protective glasses, magnifiers, ear-muffs and a breathing filter. This is standard for grinding, if you want to keep your eyes, ears and lungs.

Always keep two things in mind when using the hand-held power grinder. First, the machine is meant for light cuts. You cannot "lean into" your work. Pressing harder does not speed things up, it slows down the motor, overheats the cutting tool (or the part being cut) and eventually grinds up the stone or polishing bob itself. When you see a plume of dust arc up from the work, you are pressing too heavily. The only warning you will get with carbide is a slight change in pitch. If you persist in pressing too hard until the carbide cutter changes color, it is already too late. Take it easy. Use light, even passes with the cutting stone. Your hands should move steadily during the cut. Don't stop. The tool keeps cutting and the stone, cut-off wheel or carbide will cut a small trough in your slide if you do. Use a file for the final cosmetic touches.

Second, the cutting tool will grab the metal and yank your hand in the direction of rotation. If you do not have your hands braced when the stone, carbide or cut-off wheel grabs, your hand will be pulled into the direction of rotation. If this doesn't sound unsafe to you, you haven't had a grinding wheel race across a finger, a finger being used to keep the grinder properly located on the job. I did that, a long time ago, and recommend against it. Not only is using an un-braced hand-held grinder unsafe, you can mar the pistol.

A grinder may seem like a lot of hassle. Goggles. Mask. Hearing protection. Bracing your hands. Grinding down stones and polishing bobs to just the right diameter before using them. Why do this? What is the advantage of the Dremel/Foredom? You gain power and reach. You save time and effort. For example, modifying the ejection port of a 1911 by filing takes forever, since the longest stroke is less than half an inch. With the Dremel/Foredom you grind right to the line you marked in your Dykem. A grinder lets you do the heavy work with power.

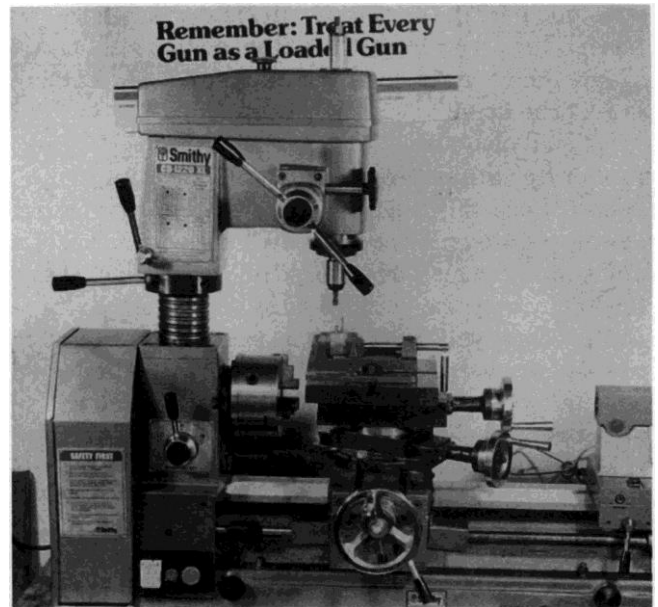
Drilling on handguns is a delicate operation. When drilling holes at home for installing lamps, shelves, or who-knows-what, plus or minus a quarter-inch ($\pm .250''$) is probably good enough. On a pistol, that is practically the next zip code. If you are off $\pm .010$ -inch drilling a hole for a scope mount, you may not be able to get the base to work. Drilling holes in handguns with a variable-speed drill is definitely out.

Only with the drill press can you properly drill on your handgun. Why drill? The primary reason is the installation of sights. If a sight uses more than the holes the factory drilled and tapped, you need to add more. The Bo-Mar rear sight requires a hole drilled and tapped for the elevation adjustment screw. The Millett Dual-Crimp front sights must have two holes drilled at the front of the slide. Mounting a scope on a handgun often means drilling and tapping holes for the scope base.

You will need drills and taps of the correct sizes, a tap wrench and tapping fluid along with your drill press. You do not need to buy a free-standing drill press. A bench-top drill press will be large enough for firearms work. Any of the hardware stores carry a large selection. You will not need a drill press with a chuck larger than half-inch. Removing more metal than this calls for a mill.



Jim Clark Jr., of Clark Custom Guns, firing up a surface grinder. This is an expensive piece of equipment that only a full-time professional needs. But it is a really neat toy.



This Smithy CB 1220 XL is large enough to handle any handgun milling need. It is also a lathe. The mill head can be used as a drill press. Three tools on one, for less cost and less floor space than three separate tools.

The big boy of the metal-removing family is the mill. Some surface grinder enthusiasts argue that for taking off large amounts of even hardened metal, the surface grinder is the king. To which I reply, "Can a surface grinder cut a dovetail?" No, but a mill can. If all you need are flats or plain notches you don't need a mill, a bench grinder and files are fine. Don't spend the large amounts of money that even a modest mill will cost if you don't need dovetails and lots of them. If you do, then consider a mill.

What can you use a mill for?

Installing a Novak front sight on a 1911 or Browning Hi-power slide is simple enough that I have seen the dovetail cut done with files. I would not do this. Using files takes too long. Filing the rear of the slide for a Novak rear sight installation is something I would recommend only to enthusiastic masochists or impoverished 18 year olds. For the detailed cutting that a BoMar sight installation needs, not even files and enthusiasm will do. You must have a mill for this.

The checkering on the front strap of many 1911 pistols is not hand-cut anymore. With the right fixture and cutting tool, the checkering is now machine cut by many custom pistolsmiths. A mill, this fixture and the correct cutting tool can save you many hours of hand-cramping filing time. And your checkering lines will be straight the first time, and every time.

A drill chuck for your mill allows the mill to be used as a drill press, with the hole spacing precisely controlled by the table movements. Once the work is positioned on the centerline, you position each hole with the mill table, and measure with your calipers just to be sure. You can drill holes for a scope base with confidence, knowing the holes will be the exact distances apart required for your base and handgun.

Slides are basically rectangular, and easy to clamp in the mill vise. Some operations go faster if you have a slide fixture. The D&J slide fixture lets you easily clamp the slide and gives plenty of room between the mill table and the tool head. You can watch the cutter in its work, and reach in to measure the work without lifting the cutter completely away from the working area. This fixture is great for cutting the scallop on the back of ejection ports. Once you have the angle worked out for the best look and performance, scribe a line on the fixture along the top of your mill vise to position the fixture the same way each time.

For work on the 1911 receiver, Evolution Gun Works makes a frame fixture that allows you to position and clamp the frame for a number of operations. You can position it for machine-checkering the front strap, removing the front strap to weld in a pre-checked panel, and turn the frame on its side to drill for scope mounts. Positioning the frame upright, the fixture lets you mill for a ramped barrel installation. When the frame is upside down you can mill off the bottom preparatory to welding or silver-soldering on a magazine funnel.

A modest mill requires either a very sturdy bench or its own stand. It, along with the necessary cutters and tools to go with it will set you back nearly \$1000. Miniature mills, while wonderful for applications such as model railroad parts or slot cars, cannot handle a large enough vise for handguns. Their motors will not be up to the heavier tasks of pistol work. The first time you run into a hard slide when you go to install a rear sight, (Colt slides are well-known for being hard-skinned) you are stopped cold. You will beat up and prematurely dull your cutters cutting through the hardened areas around soldered inserts. The hard spots around welded areas will be impossible to cut on a small mill. Remember, you don't need a mill, so if you really want one, get one that will do all the work you may encounter. For the kind of money a mill represents you can have a lot of work done to a dozen pistols.

A combination tool that covers your drill press needs and milling need is the Smithy CB-1220. As a bonus, it also is a lathe. If it were any more versatile it would brew coffee. The machine weighs 400 pounds-, so you will need a sturdy bench to hold it. It uses a 3/4-horsepower motor, and plugs into a standard wall outlet. The drill chuck handles bits up to half-inch, the mill uses standard cutters, and the lathe is long enough to hold rifle barrels. If you were to buy three machines of the same sizes you would need three times as much floor space to use them, and spend more money buying them.

If you want more than just a drill press, this is a cost-effective path to power pistolsmithing.

MINI PROJECT

In order to work on handgun frames you have to clamp them securely. When you try this you will run into several problems. Clamping isn't always easy or possible, since the rounded surfaces often prevent you from getting a purchase with the vise. Or you may find that having finally, somehow, clamped the frame, you can't get into the area you want to modify. Worst of all, if you clamp too tightly you may squeeze the receiver and distort it. Your 1911 frame won't do you any good at all if you can't get the magazine into it because you squeezed part of the receiver.

Superbar to the rescue! A bar that slides into the magazine well and locks in place, superbar prevents frame crush. Brownells offers one for the 1911 that does exactly this, but you can make one that does much more. At the industrial tool supply store, pick up a mild steel bar. Get a piece at least a foot long, sized .500-inch by 1.500-inches. If the store doesn't have this size have them mill down a slightly larger one. You'll also need a relatively small piece of steel plate 1-inch by 6-inch by quarter-inch. When you get your bar, see if they have any scraps close enough to cut or file to size. If the industrial store doesn't have one then order an 18-inch length of 3/16-inch by 1-1/2-inches mild steel from Brownells. Complete your shopping list with three cap screws 1-1/2-inches long of 1/4-inch X 20 thread, a 1/4 X 20 tap, a #7 and a 17/64-inch drill.

Clamp the bar in your vise, narrow edge up. Leave a few inches sticking out to the side. With your 10-inch American Second Cut file, start filing a radius on the long edge of the bar. You want to match the contour of the magazine well of your pistol. Radius the first inch, checking the fit to the frame until the frame will start onto the bar. Once you have the radius established, make a rough cut beveling the bar for six inches. Now, radius the bevel for an inch or so, and check fit. As the frame gets close to sliding on, use Dykem to find the high spots of your radius and dress them down. Once the receiver can be wriggled on, use the E-Z Flex Metalite cloth to make it a smooth sliding fit. Polish the radius in a shoe-shine manner until the bar and frame fit is snug but smooth.

Measure one inch down the bar on the right side, and with a cut-off wheel in your Dremel or Foredom grinder, cut a magazine catch notch. On the left side, put this notch at three inches down. The magazine catch will hook onto the bar at either of these. The right-hand notch is for locking the frame upright. The left-hand notch is for putting the frame on the bar upside-down. In both directions you can work on the receiver without the vise getting in the way.

Starting one inch from the end of the bar, mark and drill five holes, each an inch apart center to center, with the #7 drill. Tap these with the 1/4 X 20 tap. Drill the cap screw clearance holes in the mild steel plate with the 17/64-inch drill. These are also one inch apart center to center. De-burr all the holes with the #2 pillar file.

To hold a revolver frame, place the butt opening over the holes in the bar. Clamp the holding plate down with the screws to keep the frame in place. Now you can hold the revolver in any position, and work on it without the vise being in the way. With the farthest holes being five inches apart, you can also clamp the revolver through the frame opening. If you need unrestricted access to the grip area of the frame, this bar is the only easy way to securely hold the frame



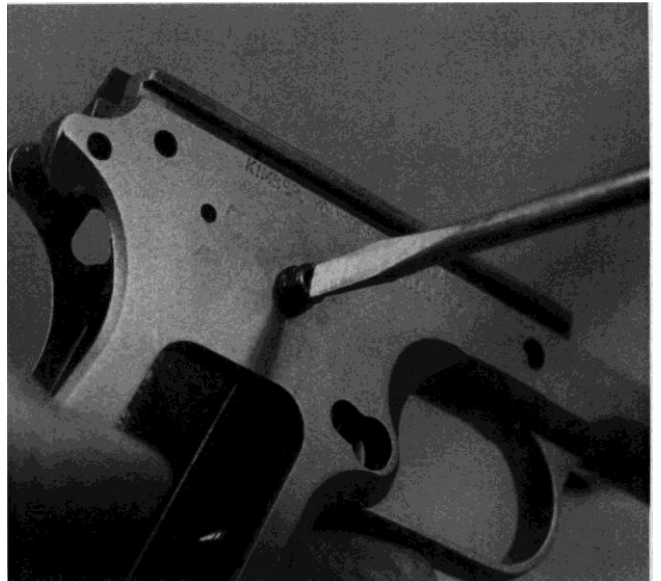
The Wilson frame holder is a solid piece of steel that allows you to hold your frame in the vise without damage. You can also make your own frame holder.



Insert the frame holder into the magazine well.



Slide the top of the holder fully into the frame.



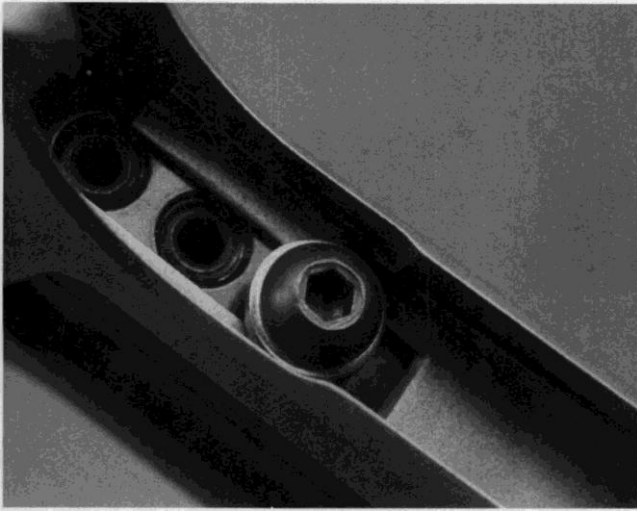
You have to remove the top grip screw bushing to clamp on the side plate.



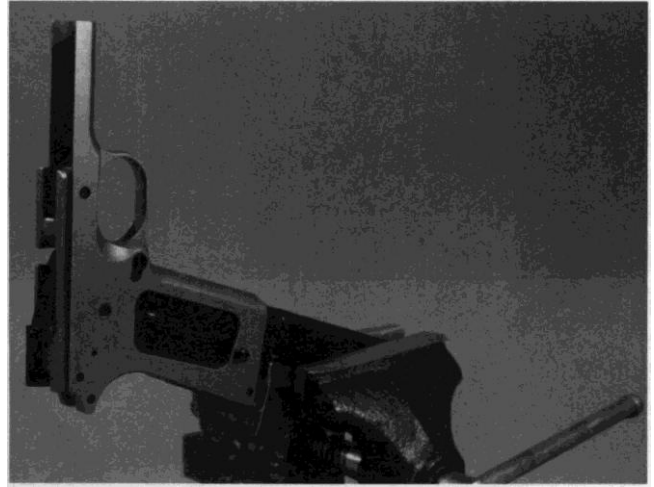
Once the bar is inserted into the frame, clamp the sideplate down.



On the Wilson frame holder, the sideplate clamps the frame to the bar. You can work on the top, front, back and left side without interference.



The Wilson frame holder has a bolt on the back that keeps the frame secured while you to work on the front or sides.



A frame holder allows you to both clamp the frame of your 1911 and work on it as well. Without the holder, securing the frame and still getting to it can be impossible.

A neat trick you can do with a mill is to adjust front and non-adjustable rear sights. Say your pistol is hitting low and you want to adjust it. The calculation involves four figures: the amount you need the bullet moved on the target, the distance to the target, the sight radius of your handgun, and the amount of correction of the sight blade. The ratio of the bullet correction to the distance to the target is equal to the ratio of the sight correction to the sight radius. An example: a pistol with a sight radius of 6-inches is hitting two inches low at 25 yards. Convert the yards to inches, and we have $2/900 = C/6$, where "C" is the correction to the front sight. Multiply both sides by 6, and we get $6 \times 2/900 = C$. Thus we find that our correction will be to mill 0.013" off of the top of the front sight.

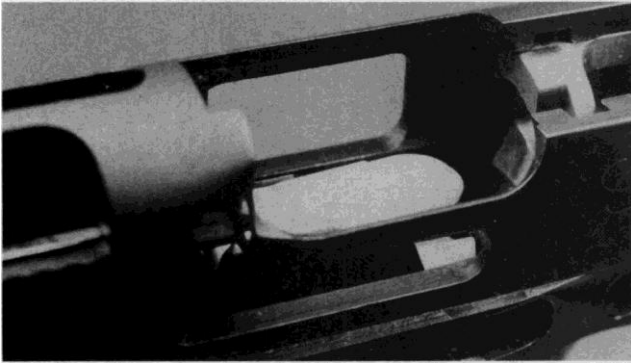
Clamp the slide in your mill vise, level it, and then dust off the top of the front sight by the calculated amount. De-burr, cold blue and viola you are done.

If you are hitting too high, and your fixed rear sight has enough metal, you can do the same thing to the rear sight with one extra step. After you have dusted off the top of the rear sight with your end mill, switch to another end mill the same size as rear sight notch (usually .125-inches) and deepen the notch by the same amount you lowered the top of the blade. If you didn't do this the notch in your rear sight would be shallower than it was before you started. When you de-burr the edges of the rear sight, be sure to round the corners on the outside, so you won't cut your hands handling the pistol. Cold blue the exposed steel, and you are done.

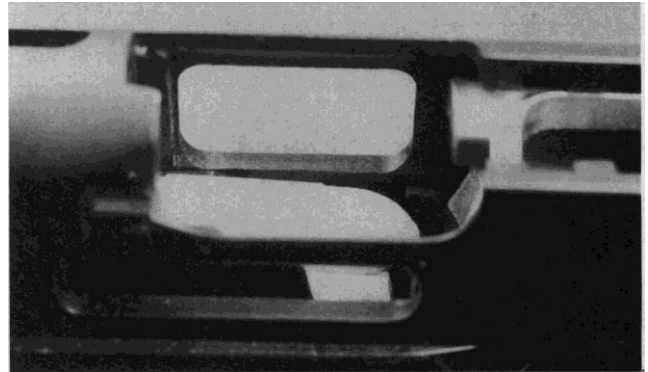
Chapter 4 - Functioning

Handgun functions are not some great mystery, happening in a sealed package from causes unknown. Unlike computer software or magic (which often seem like the same thing), when you pull the trigger of your handgun and a loud noise happens, it happens because of mechanical devices that you control. It is important to understand them.

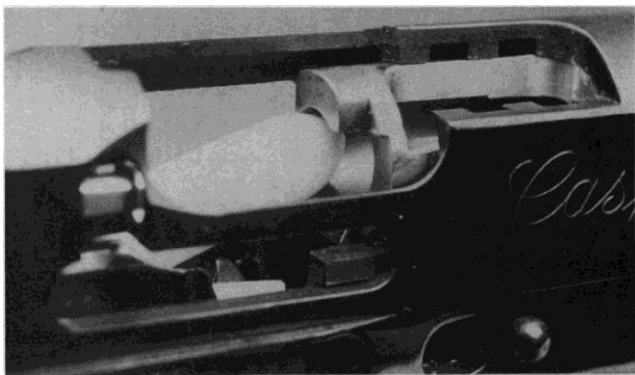
There are eight steps to the proper function of a pistol; Feed, Chamber, Lock, Fire, Unlock, Extract, Eject, and Cock.



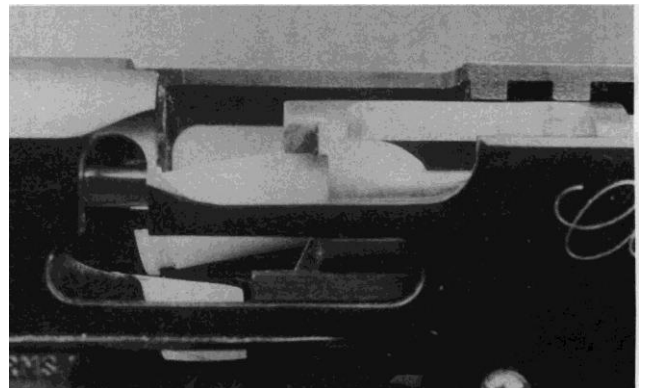
Feeding in the pistol. The slide pushes the round forward.



When the slide first pushes it, the round noses down to the feed ramp.



The ramp guides the round until it hits the top of the chamber.



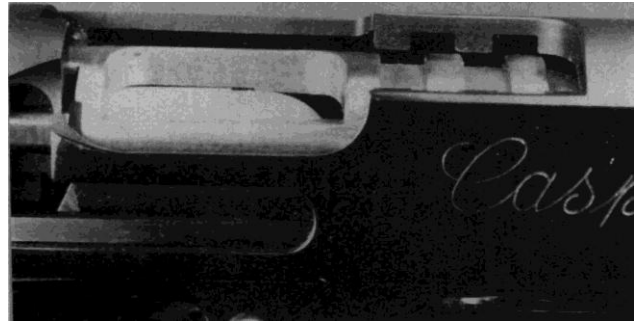
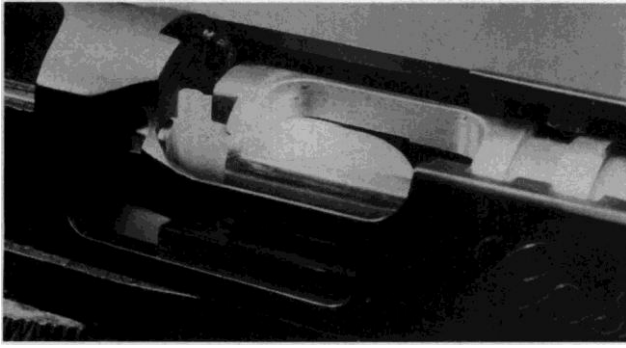
The round cams over the tip-over point, and is pushed forward into the chamber.

Feeding

The slide moves forward. It strips a round from the magazine and shoves it into the chamber. We call this feeding. What, exactly, has happened? To feed a cartridge the bottom corner of the breech face pushes against the upper edge of the cartridge's rim. The cartridge slides forward. Because the breech face contacts the rim above the point of contact between the rim and the feed lips, the cartridge tends to tilt down. (Occasionally this tilt causes problems, especially when you are using bullets of odd lengths or bullet-nose shapes. Some bullet shapes simply cannot be made to feed through a pistol because of this tilt.) When the cartridge nose contacts the feed ramp the cartridge is cammed back up to the feed lips.

Shortly after the feed lips release the cartridge the cartridge nearly simultaneously negotiates three other surfaces: breech face, chamber top, and tip-over radius. The rim slides up the breech face, the nose of the bullet contacts the top of the chamber, and the body of the case cams over the arc formed by the top of the feed ramp and the back of the bottom of the chamber, called the tip-over radius.

Now aligned with the bore, the cartridge is ready for the next step, chambering.



Once in line with the chamber, the round slides forward, until it is fully forward, and the slide begins pushing the barrel towards lockup.



In locking, the barrel cams up and the locking lugs on the barrel engage the lugs in the slide.

Chambering

There is a recess in the back of every barrel, called a chamber. The cartridge temporarily rests here until the bullet is launched, or the pistol is unloaded. How does it get here? The slide pushes the cartridge forward past the triple-whammy at the end of feeding. When the cartridge comes to the front edge of the chamber, its forward trip has ended.

Locking

A pistol mechanism must be kept closed during firing. For lightly-powered cartridges the slide weight and recoil spring tension provide enough resistance that an actual lock to hold the slide and barrel together is unnecessary. Medium and high-powered cartridges, with their greater explosive force and higher bullet weight, require that the slide and barrel be mechanically locked together before the pistol can fire.

In the 1911 the locking recesses are hidden inside the slide. A link pin that connects the barrel to the slide stop pin cams the barrel into place. On the Glock and Sig pistols the ejection port itself is the locking recess. An angled lug on the bottom of the barrel drives the barrel up into its locked position. On the Beretta 92, the locking lug is a pivoted piece under the barrel. Ramps on the frame cam it into place in the Beretta slide. Once locked, the pistol can now fire.

Firing

Firing a 1911 is simple. Pulling the trigger releases the sear from the hammer, which goes forward and strikes the firing pin. The firing pin crashes against the primer in the cartridge, setting the round off. Older generations of the 1911 held back the firing pin from the primer with a firing pin return spring. The pin was light enough, and the spring heavy enough, that inadvertently dropping the pistol was not enough to fire it by the firing pin's inertia. However, an additional firing pin safety was added to the Colt 1911 Series 80. This spring-loaded plunger blocks the firing pin from moving forward until the trigger is pressed. The linkage then pushes the plunger out of the way, and allows the firing pin to go forward. Every pistol design that has come out since the mid 1970's features a firing pin block of some kind. The Glock, having no hammer, does things differently. Here, the trigger first cocks the striker and pushes the safety plunger out of the striker's path. At the end of the trigger stroke the striker cams off the connector and snaps forward to hit the primer. Once fired, the pistol begins to unlock.

Unlocking

During firing, the locked mechanism contains the pressure of the cartridge. After firing, the barrel and slide must disengage, or unlock. The act of unlocking dissipates some of the recoil energy that firing generated. In pistols with a barrel link, the link swings the back of the barrel down out of engagement with the locking lugs. The first method developed by John Moses Browning used two links, one each at the front and back of the barrel. He soon dropped the front link. The barrel link method he designed, though, is used to this day in the 1911 pistols and all its clones, as well as Ruger pistols. Browning tinkered with his unlocking mechanism until he dropped the barrel link entirely and replaced it with a beveled bottom lug. The bevels bear against a cross pin in the frame, unlocking the mechanism. Glock, Sig, S&W Sigma all use this bottom lug unlocking method.

Since Browning last improved his design, there have been additional refinements. One of these is the “kidney-hole” lug. Used on the Czech CZ-75 and all its variations, this method works the same way as the Browning beveled lug, but is easier to manufacture. The frame doesn’t need a cross-pin installed in the kidney-hole lug pistols, because the lug cams on the slide stop pin.

The Beretta M-92 uses a method derived from the Walther P-38. As the slide and barrel move backward a small distance, a plunger pin in the back of the barrel pushes the locking block down out of engagement with the slide.

The Heckler & Koch P7 series use a devilishly simple method of unlocking. First, though, let’s look at the locking mechanism, surely the oddest configuration in use. Under the P7 slide, and resting in a tube inside the recoil spring, is a piston, attached to the front of the slide. At the back of the tube is a gas port to the barrel, just in front of the chamber. When fired, some of the gases go into this tube, creating pressure which prevents the piston from travelling backwards. As soon as the pressure drops, the pistol is unlocked. While elegant, this unlocking method is completely incapable of handling lead bullets, because the lead and lubricant from the bullet and the lead vapors created by the burning powder travel through this hole, too. Eventually the buildup prevents the piston from freely sliding in the gas tube.

Extracting

Before we can put a fresh cartridge into the chamber, we must get rid of the now-empty one. Although the barrel stops moving as soon as the action is unlocked, the slide keeps moving until it bottoms out against the frame. Inside the slide is a clip called the extractor. During feeding or locking (depending on the model) this extractor grabs on to the rim of the cartridge. Since, during firing and unlocking, the extractor remains clipped onto the rim of the cartridge, the slide now takes the brass with it. Only when the brass strikes the ejector is the empty case thrown out of the pistol.

Extractors and ejectors are only required in larger caliber pistols where high chamber pressure and greater surface area of the case require significant force to extract the case. In the smallest calibers an extractor isn’t needed; after firing, the brass in these pistols is simply blown out of the chamber. In effect, the firing pin acts as an ejector. Some pocket .22’s and .25’s do have an extractor, but only for unloading.

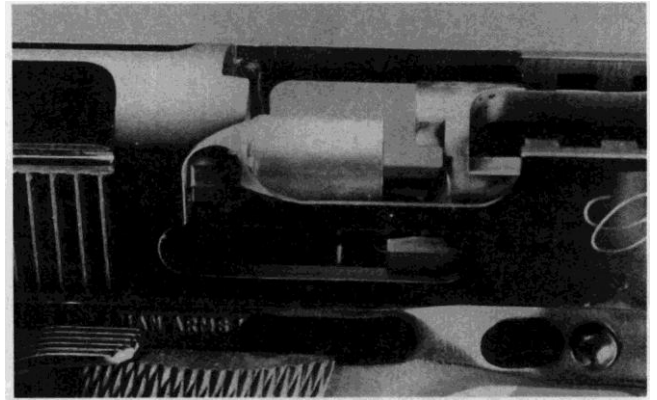
In HK pistols, fluted chamber walls allow some of the gases from firing to bleed back between the brass case and the chamber wall, effectively halving the surface area. This decreases the force needed to pry the empty case out of the chamber, though not enough to eliminate the need for an extractor. One unfortunate cost of this is decreased reloading life of the brass.

Ejection

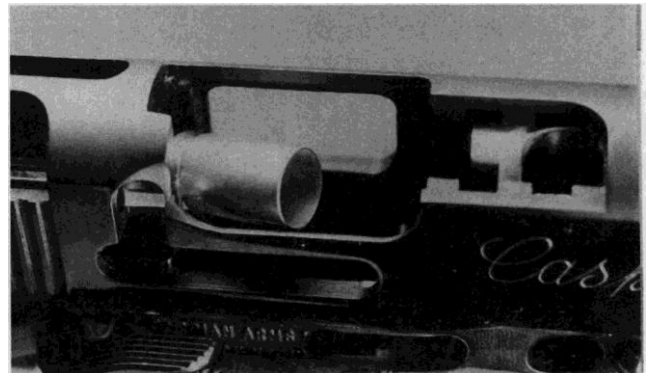
The case, extracted from the chamber, must still be removed from the pistol. We call this removal ejection. Attached to and sticking up from the frame like a post in the road, the ejector physically forces the empty case out of the pistol. Ejection, unfortunately, is not a superbly consistent operation. Extractor tension, length of the ejector, slide velocity, size and shape of the ejection port, and the firmness of the shooter’s grip all affect ejection. We will discuss what these do to alter reliable function in the chapter on malfunctions.

Cocking

When we think of cocking a pistol, we see the hero (or villain!) in an old western rotating the hammer back so he can fire again. The term cocking, however, refers to more than just this rotation. To prepare to fire again, which is what we do when we cock a pistol, other parts of the pistol must be moved as well.



After unlocking, the slide moves back, taking the now-empty case with it.



Striking the ejector, the empty pivots out and is ejected.

After firing, the trigger on all pistols must fully disconnect from the rest of the firing mechanism and then reset. In the 1911, this process begins the moment the slide moves back, depressing the disconnector in the first quarter-inch of travel. With the trigger separated from the mechanism the sear spring can push the sear back into the path of the hammer hooks, allowing the hammer to stay cocked. Now cocked, the pistol still will not fire until the shooter releases the trigger, and completes the reset.

The Glock works by a radically different mechanism. On the slide's return stroke the striker tail is captured by the end of the trigger bar. The trigger bar has been forced outside and past the cam shelf of the connector. When the shooter releases the trigger, the bar springs forward until it slips back into engagement with the cam edge of the connector. The pistol is ready to fire again.



No external safeties, only a magazine release and a slide stop lever. This is a “Double-action Only” pistol available from Smith & Wesson. Think of it as a magazine-fed revolver.

Double-Action Pistols

Double-action pistols differ from single-action pistols in two essential ways. First, they allow the shooter two choices on the first shot—to thumb-cock the hammer or trigger-cock the hammer. Second, the safety not only de-cocks the hammer, it physically blocks the firing pin from its path towards the cartridge, allowing the shooter to de-cock the pistol without the risk of discharging it.

First, cocking. If you want to pull the trigger of a double-action pistol repeatedly, the hammer will cock and then fall on the firing pin. You don't have to thumb the hammer back every time. This, the cheapest form of practice, is known as “dry firing”.

In dry firing, each time you pull the trigger the hammer is cocked back and then released, and the firing pin block is cammed up out of the path of the firing pin, letting it fly forward. (You can also dry fire the pistol by thumb-cocking the hammer, and then pressing the trigger, as you can with a single-action pistol.) Is dry firing bad for the mechanism? Not really. You may find, after 100,000 times or so, that the firing-pin spring on your pistol is beginning to fatigue. I dry fire my pistols all the time, though, and have yet to have to change a firing pin spring.

When you actually fire the pistol, the slide cycling back will cock the hammer. Your second and subsequent shots will require a shorter and lighter trigger pull, very much like that on the single-action pistol.

A very few pistols do not allow you to use the trigger-cocking mechanism more than once. These are puzzlingly referred to as — I'm not kidding here and I didn't make this up — “Double-Action Only” pistols. If you attempt to fire a chambered round in a Smith and Wesson DAO pistol and it fails to go off, you will have to cycle the slide by hand to re-set the mechanism. This is also the case with the Glock, although Glock refers to their mechanism as “Quick Action.” In both cases, pulling the slide back a fraction of an inch and letting it go forward again resets the trigger linkage. You'll still have a bad cartridge in the chamber. Better to reset the mechanism by ejecting that cartridge; you can try again with the next one.

Second, safeties. On all double-action pistols the safety lowers the hammer without discharging the cartridge. Individual models, however, differ in what they do next. The Smith & Wesson is the starting point for comparison. When the slide-mounted safety on a Smith is pushed down, it locks the mechanism, drops the hammer and stays down. As long as the lever is down, the pistol will not work. The Beretta M-92 works the same way.

The Sig-Sauer is different. The spring-loaded safety lever is on the frame. When you push the safety lever down, the hammer drops. Since the firing mechanism is already locked, the pistol won't fire. When you let go of the lever, it springs back, and the pistol is ready to fire by simply pulling the trigger.

Is one “safer” than another? In both cases the firing mechanism is locked against firing from dropping, but if you pick up the Sig and press the trigger it will always fire. If the safety is “on” on the Smith & Wesson, the pistol won’t fire. Safety is a matter of training. Safety also depends on whether you expect a pistol never to fire, or always to fire. As Jeff Cooper has said, “Safety is a matter of what is between your ears, not what is between your hands.”

All DA pistols have positive firing pin blocks. Unless you pull the trigger, these pistols will not fire. At rest, the hammer on the Sig is actually spring-loaded away from the firing pin and slide, and locked by the trigger bar. The Smith and Wesson simply rests the hammer against a shoulder of the safety body.

The Glock lacks any external safety levers; the mechanism isn’t cocked until the trigger is pulled. When it first appeared the Glock was viewed by some as an invention of the devil, for here was a pistol with no apparent safeties. Hours of patient explanation and liberal use of factory cutaways showed shooters that the Glock was safe. It has three safeties, discussed in Chapter 16, and is essentially a magazine-fed revolver in operation and safety.

Smith & Wesson’s have yet another safety, the magazine disconnect. Only Smith and Wesson has this. Even with a round in the chamber, and the slide-mounted safety off, unless the magazine is in place, the pistol will not fire. Firearms Instructor and Director of Lethal Force Institute Massad Ayoob has documented that this feature has saved the lives of a dozen police officers. He is well-known in police circles, and has a standing request for information on the subject. If a magazine disconnect is such a good a feature, though, why don’t all pistols have it?

A magazine disconnect must be designed in at the beginning of a pistol’s life. Retro-fitting is an engineering nightmare, and would confuse shooters. How to tell if a particular gun had or did not have a magazine disconnect? By trying to fire it? Still, why haven’t more manufacturers designed models with magazine disconnectors?

Simple. Some shooters do not like them. They cause a few inconveniences. For one, dry-fire practice now requires an empty magazine. Two, the extra safety parts almost always make the trigger pull heavier. The main objection, however, is that the lack of a magazine makes the pistol completely inoperative. In an emergency, a pistol without a magazine safety can still be used even without a magazine, albeit as a single-shot pistol. A pistol with a magazine safety cannot. If you have children, or are a police officer who may have his pistol snatched, the magazine safety can be a blessing. For many competitive shooters it is at best a curiosity, and at worst an annoyance.

The Eight Action Steps Of A Revolver

Unlike the pistol, many of the actions of the revolver are directly performed by the shooter.

CHAMBER

Chambering a revolver is entirely unlike chambering an autoloader, but the operation is indicative of the differences between these two types of handguns. To chamber a revolver the shooter places a cartridge or cartridges directly into the chambers of the cylinder, either one at a time by hand or in multiples with a speedloader. The cartridges must drop fully into the chambers, or the cylinder will not close.

CLOSING

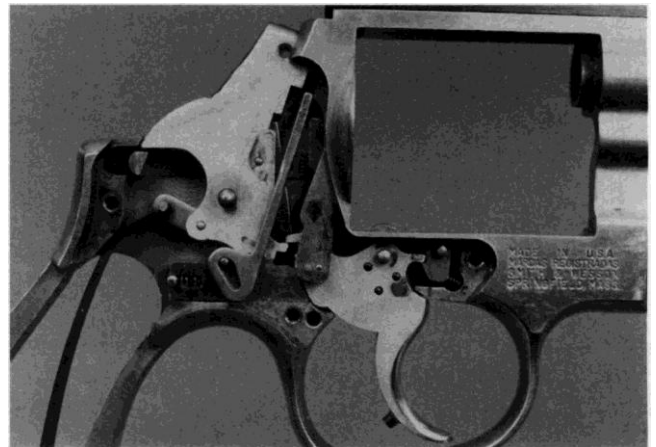
In a single-action revolver, the only closing you have to do is with the loading gate. Swing it back into place, and the cylinder is closed.

All double-action revolvers have a swing-out cylinder. This cylinder must be closed or the revolver will not function. Insufficiently chambered or poor-quality cartridges can interfere with closing. A gentle click into place lets you know the revolver is ready to go.

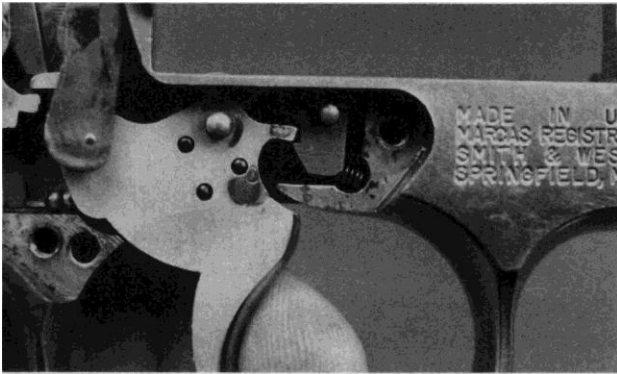
ROTATE

After closing, the cylinder on a revolver must rotate before firing. The part directly rotating the cylinder is the hand. With a single-action revolver, the hand is attached to the hammer, and cocking the hammer thus rotates the cylinder. Merely pulling the trigger does nothing.

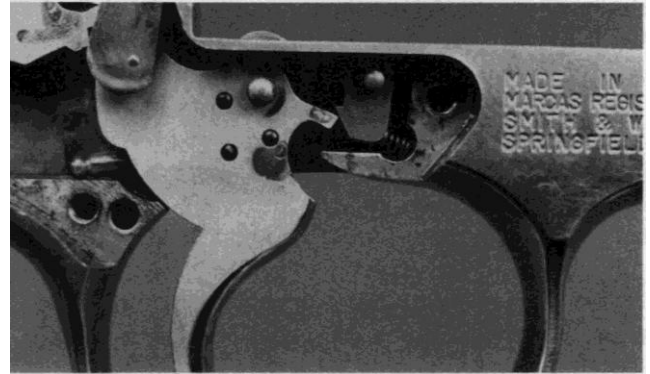
In the double-action revolver, the hand is attached to the trigger. You can still rotate the cylinder by cocking the hammer, which allows you to leave the gun cocked but not fired. In addition, you can rotate the cylinder by pressing the trigger, which leads directly to firing the revolver. You cannot trigger-cock the revolver and leave it cocked; it fires at the end of the stroke.



The lockwork of a Smith & Wesson revolver.



At the beginning of the action, the front of the trigger pulls the cylinder locking bolt down, releasing the cylinder to rotate.



Once the hand has begun rotating the cylinder, the locking bolt pops back up, ready for the next locking slot of the cylinder.

In testing rotation, the travel to the fully upright and locked position is called “carry-up”.

Anything that interferes with cylinder rotation can render the revolver unsafe or inoperable.

COCK

Cocking a revolver is inextricably linked to rotating the cylinder.

On the single-action revolver, the trigger is a simple lever. At its tip is the sear. Cocking the hammer pulls the sear up until it drops into the full-cock notch. The revolver is now ready to fire.

In the double-action revolver, the trigger is shaped differently but does the same job. The hammer has both a single-action full-cock notch, and a double-action notch. (In the typically perverse firearms terminology, this hammer “notch” is referred to as the “DA sear”.) On hammer-cocking, the hammer pulls the trigger up and stays there. In trigger cocking, the trigger pulls the hammer up and releases it, firing the revolver.

You can watch both the single and double-action of cocking and firing by taking the sideplate off of a DA Smith & Wesson revolver. Take care, as the parts, free of the sideplate, will try to wiggle out of the receiver. Watch in slow motion, as you hammer-cock or trigger-cock the revolver, and the dramas play themselves out before you.

FIRE

Firing is simple. You pull the trigger, and, assuming you have loaded the revolver, the hammer crashes down onto the waiting primer. If you have not, then all you hear is a click. (You have just dry-fired the revolver.) If you were expecting a bang, you will understand why this sound is called the loudest sound on earth.

TRIGGER RETURN

Single-action and double-action revolvers also diverge in operation at the trigger return.

After firing a single-action revolver, you may release the trigger, cock the hammer, and press the trigger to fire again. Or you may hold the trigger down and cock the hammer. Releasing the hammer with the trigger depressed will also fire the revolver.

After you have fired the double-action revolver, and before you can fire again, you must release the trigger. Moving your trigger finger forward allows the trigger return spring to push the trigger back to its re-set position. If the trigger does not return fully, the mechanism cannot re-set, and will not fire. Called “short-stroking,” and not uncommon in fast DA shooting, this mechanical malfunction can be the result of a shortened spring or a sluggish trigger.

If after firing a DA revolver, you hold down the trigger and cock the hammer, the cylinder will not rotate, and the hammer, when released, will fall on the same cartridge you just fired.

OPEN

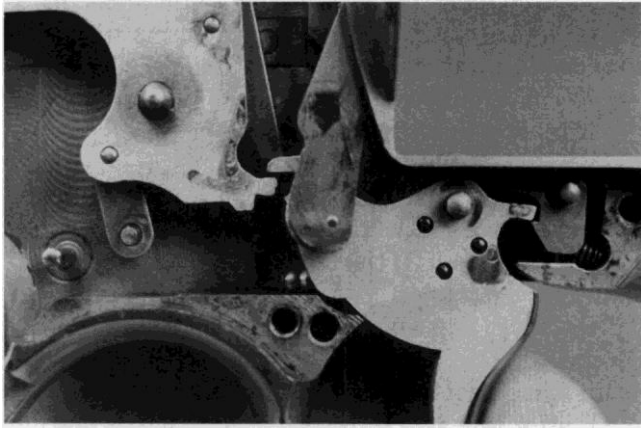
To remove the empty cases, you must open the cylinder.

If, in a single-action revolver, you remove the center pin from the frame, the cylinder will drop free and you will have three parts to juggle. Instead, open the loading gate, and in older models, draw the hammer back to its “safety” notch. This unlocks the cylinder without removing it, allowing you to rotate it by hand and push each empty out with the ejector rod.

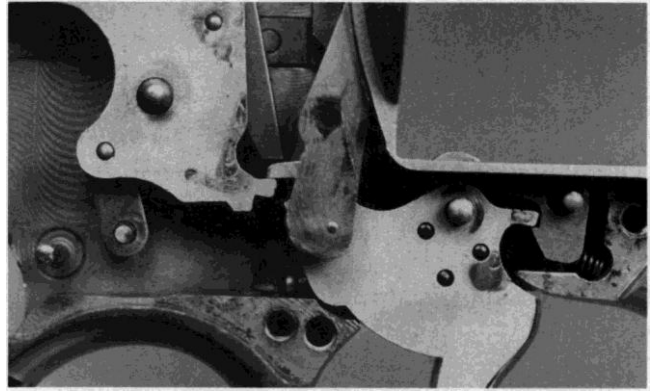
On newer model SA Ruger revolvers, simply open the loading gate to unlock the cylinder. You do not have to fiddle with the hammer. Eject each empty one at a time.

On double-action revolvers, unlocking the latch allows you to swing the cylinder out of the frame, again without removing it. Pressing the ejector rod ejects all of the cases at once.

The location of the release latch varies from manufacturer to manufacturer, although each thankfully is consistent in its own models. The Colt, Ruger and Smith & Wesson all locate the release behind the cylinder on the left side of the frame. To release each cylinder you: (1) push the S&W latch forward, (2) pull the Colt latch back, or (3) push the Ruger latch into the frame. The Dan Wesson latch is forward of the cylinder, on the left side. Pull it down to open the cylinder.



On double-action shooting, the rear tip of the trigger pushes the hammer up.



On single-action shooting, the front of the hammer pulls the trigger up with it.

EJECT

Just as you must load a revolver by hand, you must eject empties by hand.

A revolver does not automatically toss the empties aside, though if you look at a century-old advertisement, you will see revolvers touted with “automatic ejection”. What is this? Why don’t we have such revolvers now?

Well, we do. It is the language, not the revolver, that has changed. A hundred years ago, ejection from single-action (cowboy) revolvers was always one empty at a time. The advent of double-action revolvers with swing-out cylinders led to simultaneous ejection, a high-tech improvement labeled, not surprisingly, “automatic.” The actual ejection method is identical, then or now. On the single-action revolver, you press the ejector rod for each cartridge, empty or loaded. On the double-action revolver, pressing the ejector rod on the front of the cylinder raises the ratchet, or extractor star, and pushes the rounds out of their chambers. When they are pushed far enough from the chamber, their weight will cause them to fall away from the cylinder. The revolver has no way to distinguish fired from unfired rounds, so all will be ejected.

Learning about the operation of your pistol can save you from some of the more common errors in home gunsmithing.

Say you want a lighter trigger pull. Your first thought might be that you need a new hammer spring. You could change the spring. Or maybe you’re thinking the trigger spring is off. You could replace it. Possibly the magazine safety is causing the problem, or the obviously rough surfaces on the trigger parts. It’s tempting just to dive in and start changing everything that catches your eye.

The truth is that hammer springs, trigger springs, magazine safeties, rough finish on trigger parts—all affect your trigger pull. Even worse, none of them may be the cause of the particular problem bothering you. If you go in and start making wholesale changes without knowing what’s really going on, you’ll end up with a pile of parts and a huge headache. Or maybe you end up with your pistol all put together, working no better than it did before.

Simply switching to lighter springs can make the trigger pull feel lighter. Not always, though. You must know which springs to adjust, and how much to adjust them. Those rough surfaces on the trigger assembly? If you’ve gone ahead and replaced some springs, the trigger pull, now lighter, may feel worse because of those very surfaces. Should you go ahead then and “clean up” those parts? You’re heading toward the headache for sure, now.

Pistol manufacturers want to make the trigger pull of your pistol as light and clean as they can, but the manufacture of small parts in precise dimensions with ultra-smooth finishes is expensive. Manufacturers must balance costs against sales. While an improved trigger pull may only add \$10 to the end cost, the increased price cuts too far into sales to justify doing it.

The manufacturer of your pistol has designed the hammer spring to be heavy enough that the hammer will set off every primer ever made—no matter how old it is, no matter how cold the weather is, no matter the condition of the oil coating, and possibly slowing down, the hammer and firing pin. If you jump in and ease the spring weight of the hammer, you are giving up some of this extra power. Your pistol may “feel” better but “work” worse. I have test-fired handguns, for example, that fired fine indoors but refused to work outside on a cold winter day.

Similarly, the design of a trigger return spring on a revolver must cover a variety of shooting equipment and conditions. Adjust that spring too much in the effort of making the trigger pull extremely light, and you may find it is now too light to return the trigger promptly. Many super-light DA revolver trigger pulls have such sluggish trigger return that they can't be fired quickly, though they work fine at the very slow pace of PPC competition. While you're jumping in with lighter springs for your revolver in hopes of lightening that trigger pull, the fastest revolver shooter alive, Jerry Miculek, keeps factory standard trigger return springs in his revolvers. For a while he even experimented with heavier than normal springs, so the trigger could keep up with his finger.

I think it's a bad idea to make hammer and trigger springs very much lighter than what the factory installed. When we get to the section on trigger improvement I'll show you where the real trick lies—in the fit and finish, not the spring weight.

Or say your pistol just isn't feeding properly. A common mistake, again, is to exchange the factory-installed recoil spring, this time for a heavier one. Early in the modern era of pistol shooting, famous-name writers even suggested using an extra-heavy recoil spring in a 1911, but these 22-lb springs had serious drawbacks. Unless the shooter was using heavy loads and had a stiff wrist, the empty brass would not always eject. Trading "stovepiping" for unreliable feeding can hardly be considered an improvement in functioning.

Remember, the manufacturers install spring weights of a certain range for good engineering reasons. Think carefully before you shift very far from what they install. An extra-heavy spring, just like an extra-light one, can cause more problems than it solves. Want your gun to cycle faster? Think you'll beat the competition if you use a significantly lighter recoil spring, and force the gun to unlock faster? While the gun will cycle faster with the lighter spring there is a cost: the slide will bottom out against the frame harder than it was designed to. When it does, you will feel the vibration rattling the gun, and you. Can you stay composed? This harder impact also wears the locking lugs of the slide and barrel at an accelerated rate. Some top-level competitors do use lighter-than-normal springs, because they can handle the vibration and they are willing to give up 80 to 90 percent of a pistol's service life in order to save a few fractions of a second in a match. If you want to replace your pistol after each season of competition, this modification is good way to do it.

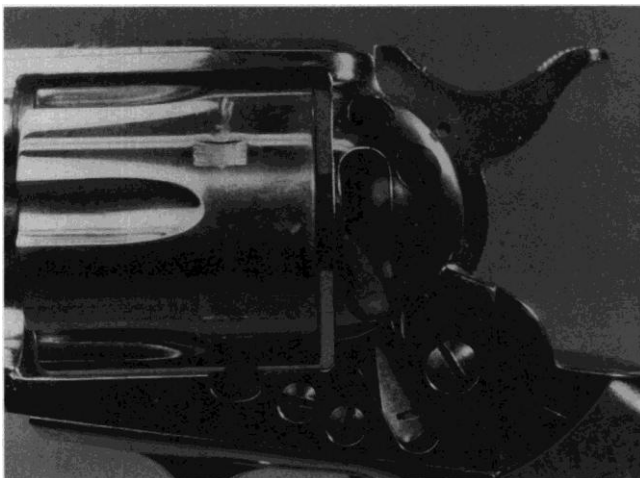
You can use recoil springs somewhat, but not much, lighter than the factory originals. I have gone as low as 14 pounds for 1911 pistols being fed "Major" loads. According to my records, I have gotten two tons of lead downrange through my pistols, and haven't had to retire any of them yet.

The Single-Action Revolver:

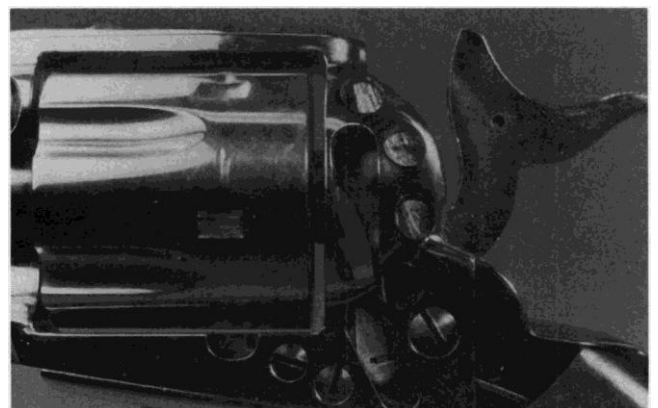
They Might All Look the Same, But They Are Not.

Anyone who has ever seen one of the thousands of Westerns turned out by movie studios and television production houses has seen a single-action revolver in use. Originally designed by Samuel Colt in the 1830's, the single-action revolver was a technical tour-de-force. Before Colt, pistols were either single-shot, requiring the shooter to reload after each round, or, even more complicated, not just single-shot but single-shot/single barrel—with each separate shot requiring its own separate barrel. Needless to say, such a pistol was very clumsy, heavy and expensive to use. And as a method of defense, either type of pistol was not very practical. Unless you were a Jim Bowie, a pair of single-shot pistols and a knife meant you were at the mercy of any three or four attackers. Samuel Colt's single-action revolver forever changed that. With its advent any man or woman could possess a light, durable package that was not just easy to use, but extremely useful against attackers.

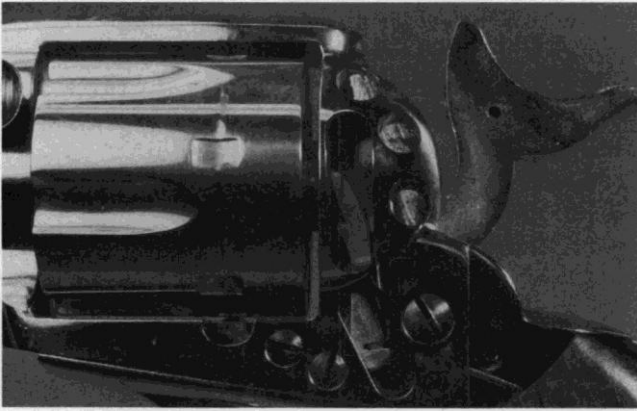
Despite drawbacks that were obvious from the start, single-action revolvers reigned supreme for decades. In the 1950's they even enjoyed a renaissance that continues to this day, and the renewed interest has helped work out some of the safety problems with the original design.



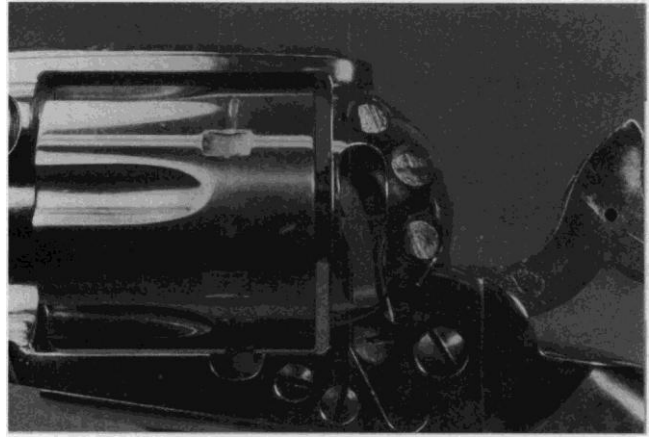
The first notch, or so-called safety notch of a single-action revolver holds the firing pin away from the primer. Don't trust it! Load old-style single-action revolvers so the hammer rests on an empty chamber. A blow to the hammer can fire the round under the firing pin.



The second notch releases the cylinder lock, and allows you to rotate the cylinder for loading or unloading.



Continuing cocking past the second notch begins rotation of the cylinder and releases the locking bolt.



At full cock the cylinder is locked, the hammer is cocked, and the hand is fully lifted.

What were the drawbacks? Most significant was safety, for under certain conditions the revolver could fire seemingly at will. The mechanism itself was fragile, containing parts and springs that failed under minor stresses. Not counting an accidental discharge, there was no way to fire the revolver without first thumb-cocking the hammer. And, because the cylinder stays in the frame for loading and unloading, they were clumsy to use.

Unloading and reloading each chamber one at a time is a fussy operation even at a range. In the cold, or dark, or under stress, it becomes very difficult. Cocking the hammer to fire each round is a slow method of shooting.

None of these problems, though, was serious enough in the 19th Century to send people back to old single shot pistols or get them itching for even better guns. Instead, they found an easy way around both difficulties: they simply carried a second, loaded revolver. Far from being the mark of a paid gunslinger, carrying two guns was the act of a prudent man.

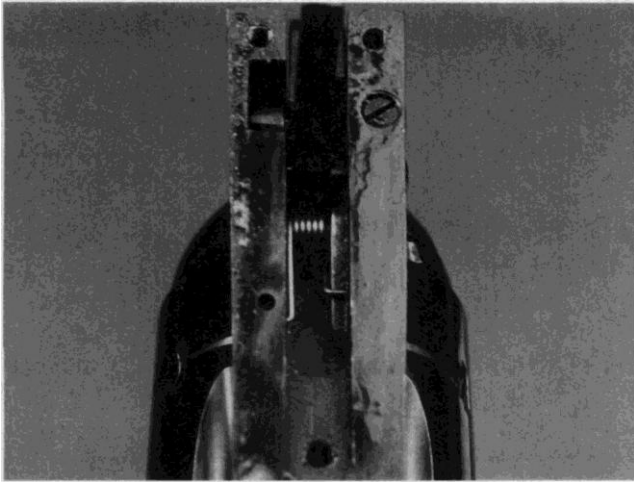
Despite its apparent sturdy looks, the design of a single-action revolver contains some fragile parts. The trigger/cylinder lock spring, flat, and ending with two fingers, is prone to breaking at the fingers. Replacing a spring is not a big deal, generally, except that with this particular one the operation requires removing and replacing not less than eight screws. Another flat spring, the hand spring, (so named because it presses the hand into the ratchet, and its base is staked into the hand), breaks easily. When it does, or when it simply comes loose, the hand will not bear against the cylinder, and the cylinder won't rotate. The so-called "safety" notch on the hammer tends to break at its shoulder. When this happens the hammer rests directly on the cartridge beneath it, and the revolver will fire as a result of a sharp blow.



The Ruger re-design of the single-action revolver replaced the flat mainspring with a coil spring that works over a shaft.



After cocking the mainspring, place a punch or small screwdriver through the hole in the shaft. Remove the five screws, and the grip frame comes off. The plunger in the trigger guard is the trigger return spring and plunger.



The flat two-leaf spring in the Colt is replaced with a coil spring in the Old Model Rugers and a spring and plunger in the New Model Rugers.



The Ruger firing pin is in the frame.

With his internal re-design of the single-action revolver in the early 1950's, Bill Ruger replaced the flat springs with coil springs. These springs do not break or wear out. There are, however, still an awful lot of screws in there. There's only so much anyone can do and still keep the flavor of the revolver.

With proper care you can expect years of use from even the fragile Colt or its clones. But if you abuse them, they complain. Fanning is a major source of trouble. We all know what fanning is: on his fast-draw, the movie hero holds the trigger down and slaps at the hammer with his left hand. Fanning is very hard on the revolver, battering the locking bolt and slots and peening the hand and ratchet. Along with fast-draw, fanning is also a major risk factor for dropping the revolver, which is really hard on it. Dropping a revolver can bend the barrel, sight, cylinder pin or grip straps. It can also bend or break the screws that hold the grip frame to the receiver.

The main problem with a single-action six-shooter, then and now, is safety. If the hammer is rested not on an empty chamber but on a loaded round, any blow to the hammer can cause the revolver to fire. There is a simple solution. Rest the hammer on an empty chamber, effectively turning your six-shooter into a five-shooter.

As legions of cowboys learned, it doesn't take much force to set off that 12 o'clock round in a fully-loaded six-shooter. The classic "cowboy limp" was often the result of simply saddling a horse. The cowboy would pick up the saddle, swing the nearside stirrup over the top and then place the saddle on the horse. Tossing the stirrup up onto the saddle allowed him access to the cinch. If the horse moved while the cowboy was bent over tightening the cinch, that stirrup could slide off the saddle and fall right onto the cowboy's exposed hammer spur. The rest would be painful history. Stirrup would hit hammer, hammer would discharge primer, exploded primer would send bullet down barrel, and bullet could hit cowboy in the leg or foot. With bad luck, lack of medicine, or a long ride back to help, the cowboy could die.

The essential "un-safeness" of single-action revolvers is so well known to some that it earned a mention in John Wayne's last movie, "The Shootist," when our hero told his would-be protege that revolvers were only carried safely with five rounds. Unfortunately, this safety drill was not so familiar to the numbers of people who were buying single-action revolvers in the 1950's and 1960's during the cowboy movie inspired fast-draw era. Competition required single-action revolvers, and since there were six chambers in the revolver, many shooters assumed they could load all six. Not so. Loud and unexpected "Bangs!" taught them quickly: always load five, and only five.

The traditional method of making an SA revolver safe was to load one round, skip the next chamber, load four more, cock the hammer and lower it. If you haven't missed the count, the hammer now rested on an empty chamber.

Bill Ruger wanted a better way, so when he redesigned the mechanism he moved the firing pin from the hammer to the frame. He lightened the firing pin, and spring-loaded it away from the primer. The redesigned firing pin was so light that its own weight could not overcome the spring and strike the primer, even if the revolver is roughly handled. This was not enough. The Old Model SA Rugers could still fire inadvertently. So, in the second redesign, he cut away the face of the hammer. This change rendered the revolver inoperable as the hammer could no longer engage the firing pin. To make it possible to fire the revolver, Ruger then attached a transfer bar to the trigger. When pressed, the trigger moves the transfer bar into the gap between hammer and firing pin, filling it and allowing the force from the blow of the hammer to transfer to the firing pin. As soon as the trigger is released, the transfer bar slides out from between the hammer and firing pin, breaking the connection.

These improved SA revolvers are called “New Model” Rugers. You can tell at a glance if a Ruger is a New Model. Just look for the cross pins with which Bill Ruger replaced the hammer and trigger screws.

As an even more impressive design improvement, Bill Ruger figured out how to retro-fit safety bars in his earlier revolvers. If you have a single-action Ruger revolver that pre-dates the safety bar design, you can send it back to Ruger for a free installation of the new parts. Other than allowing you to load six rounds safely, the new parts don’t change your SA’s function, they don’t alter its look, and you even get your old parts back. If your revolver is of some historical significance, you can always reinstall the old parts. To check an Old Model Ruger for the transfer bar, cock the hammer and look into the hammer slot in the frame. The flat bar will be obvious.

Current production single-action revolvers fall into two groups. The first are the Colts and all their clones, including the early Rugers that have not had the safety bar retro-fit. None of these revolvers have a transfer bar and if fully loaded the hammer sits right on the primer of the 12 o’clock round. Even the Italian clones, shipped with Federally-mandated mechanical safeties, are not safe with six rounds. I don’t trust them because the safeties only work if you move the centerpin, or shift a stud on the hammer. If you forget, the revolver is still unsafe. My personal rule with any of these revolvers is to load only five rounds in them. I never break this rule. The consequences are just too serious.

The second group are all Rugers built since the “New Model” design change, and old Rugers retrofitted with the safety bar. These can be carried with all six rounds chambered.

One nostalgic loss in the New Model Ruger was the loss of the “four clicks”. In order, they were: The so-called safety notch, which isn’t, and shouldn’t be trusted as such, the unloading notch, the locking bolt clicking back into place against the cylinder, and the hammer full-cock notch. The New Model has two clicks: the locking bolt snapping against the cylinder, and the hammer going to full cock. Ah, the sound of progress.

By the turn of the century handgun designers had figured out how to overcome the shortcomings of the SA revolver, and what they came up with we know as the double-action revolver. Iver Johnson had an advertising campaign entitled “hammer the hammer”, showing someone pounding on the hammer spur of one of his revolvers without firing the round under the hammer. Even so, for decades after double-action revolvers came into use shooters carried their revolvers with the hammer down on an empty chamber. The Pennsylvania State Police even went so far as to make it regulation. Through the 1950’s officers carried their Colt double-action revolvers with only five rounds.

Buying a used 1911

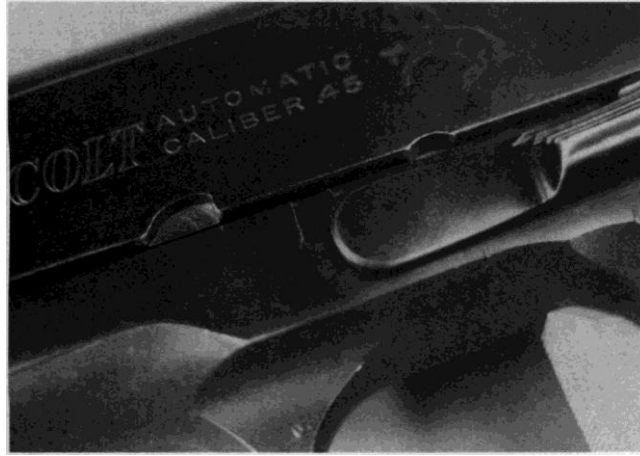
When you’re considering a used 1911, start with a good visual inspection. Has the exterior been abused? Hammer marks or rough file marks on the outside should make you wonder how careful the previous owner was with the inside. If the original blued surface is now grey from years of use and carry, but the owner never dropped it and fired it seldom, you have a great opportunity. The looks are likely to bring the price down, but mechanically it can be just fine. If it is a pistol used in competition you might be able to find some answers by asking about its history with other competitors. Did the previous owner have a reputation of always shooting unreliable guns? Or were his pistols always reliable, just ugly?

After the visual inspection, start checking the operation. If you haven’t already done so, make sure the pistol is unloaded, and tell the clerk at the store that you want to perform some safety checks. Cock the pistol and dry fire it. Was the trigger pull very light? A very light trigger pull will have to be made heavier to be safe and durable. Or was it very heavy? Did it feel as if it was crunching through several steps before it finished its job? A very heavy or gritty trigger pull will have to be made smoother and lighter.

Execute a “pencil test.” Cock the pistol and drop a pencil down the bore, eraser end first. Point the pistol straight up, and dry fire it. The pencil should be launched completely out of the pistol. If it isn’t, something is keeping the firing pin from its assigned duties. Find out what before you buy.



When you buy a new handgun now, it will come with some sort of warranty. If a part breaks, and the manufacturer is at fault, and you haven’t modified it, you’ll get it fixed. Put a couple of hundred rounds through a brand-new handgun before starting to work on it. If anything breaks, it is still under warranty.



Some “problems” are cosmetic. This crack in a 1911 has been the same size for over 10 years and 5,000 rounds. There isn’t any real need to weld it up and re-finish the frame.

You must perform a mechanical safety test. Cock the hammer again and push the thumb safety on. Holding the pistol in a firing grip, press the trigger a bit harder than you would to fire it. Seven or eight pounds of pressure is sufficient. Let go of the trigger, and push the thumb safety off. Now hold the pistol next to your ear, and slowly draw the hammer back. You should not hear anything. If you hear a little “tink” when you draw back the hammer, the thumb safety is not engaging fully.

If you heard the “tink,” here’s what happened. When you pulled the trigger with the safety on, the sear moved a tiny amount. It shouldn’t have. The hammer tension kept the sear from moving back into position. When you held the pistol close to your ear and drew back the hammer, that tension on the sear was removed. The sear spring pushed the sear back in place, causing the tink you heard. If the hammer stayed cocked, the sear only moved a tiny amount. The fix is easy. What if you never got to the “tink?” If the hammer fell when the safety was pushed off, before you even tried to listen, the thumb safety fit is very bad and you will have to buy and fit a new safety. In the worst case, the hammer falls even when the safety is on. These also need a new thumb safety.

Next test the grip safety. Cock the hammer, and, holding the frame so you do not depress the grip safety, pull the trigger. Release the trigger, and, now grasping the pistol so you do depress the grip safety, hold the pistol up to your ear again and draw the hammer slowly back. If you hear a tink, the grip safety is barely engaging. Look at the grip safety. Because some competitive shooters don’t feel the need for one, they grind the tip of the grip safety off where it blocks the trigger. If this has been done to the 1911 you’re thinking of buying, you will have to have the tip welded back up, and fit it to the trigger. If the tip hasn’t already been ground off, or otherwise altered, you’re looking at an easy fix. It is probably just a simple mis-fit, which you can correct with peening.

The last test you need to perform is hammer/sear engagement, or hammer flick test. There’s a good way and a bad way to perform this test. In the caveman days we would lock the slide open empty. Then we would release the hold-open lever and let the slide crash home on an empty chamber. This is more like abuse than a test, especially since it doesn’t fairly test the hammer sear engagement. Continued “testing” this way can actually do harm to your hammer and sear. In the modern, improved “flick” test, you cock the hammer, grip the pistol so the grip safety is depressed, and hold down the thumb safety. With your other hand, flick the hammer back against the grip safety, and let the hammer go forward to sear engagement. This nondestructive test can be performed until the cows come home, or your fingers bleed, and will not harm the sear and hammer hooks. If, however, during this test the hammer falls—even once—the hammer/sear engagement will require work. You cannot depend on this pistol to stay cocked when firing. The pistol may simply require re-stoning the engagement surfaces, or it may require a new sear, or both new sear and hammer. Until you look at the engagement through a magnifier, there is no way to tell.

Aside from the grip safety check, which is unique to the 1911, these tests can be performed on any other pistol you might be considering for purchase, though double-action pistols require a modification of the thumb safety test. With the pistol unloaded and the hammer cocked, again place your pencil down the bore eraser end first. Point the cocked pistol up, push the hammer drop safety down to its safe position, and drop the hammer. The pencil had better not move at all. If it does, something is seriously wrong with the safety, and the future travel plans of that pistol include a trip to the factory. Push the safety off. With the muzzle pointing up, dry fire the pistol. Pick the pencil up off the floor, or investigate the firing pin’s malfunction.

With the safety checks out of the way, look for signs of abuse or experimentation. Take the slide off the frame, and look at the frame rails. Have they been peened to tighten the fit? Even an ugly peening job can be fine, if the parts have been lapped for a smooth fit. If you’re looking at an after-market frame and slide combination like the Caspian, put the slide back on the frame without the barrel and recoil spring assembly. Such combinations left the manufacturer as a tight fit and were lapped to slide smoothly. If the pistol is now very loose, it has had many, many rounds through it. The barrel may need to be replaced. The price had better reflect this.

With the slide off, look at the feed ramp. Has it been polished? Polishing is fine. Has it been reground, altered or subjected to an incorrect “feed” job? These alterations can be a problem. If the ramp has been incorrectly altered, the pistol will feed poorly, and if the top of the feed ramp has been rounded off, the pistol will not feed at all. Take the barrel and place it on the frame in its unlocked seat, ahead of the feed ramp. Push it all the way back into the cutout, and check the relationship of the barrel to the feed ramp. There should be a small gap between the bottom of the barrel and the top of the feed ramp. A smoothly rounded and blended fit is the indication of a bad feed job. Such a pistol will feed only with round-nose, full metal jacketed ammunition. Anything else will hang up. The fix, which involves welding the frame and re-cutting the surfaces is expensive. Unless you can get the pistol for a song, pass on it.

Look closely at the barrel. The feed ramp of the barrel should not be altered, only polished. Ramping the barrel deeper into the chamber was a prehistoric method of ensuring reliable feeding, and is not an acceptable practice anymore. An over-ramped barrel has to be replaced. Look at the locking lugs. Are they clean and sharp? They should be. If they are rounded, or show a set-back shoulder or burred edge, the barrel was improperly fit to the slide. If only the barrel is damaged, a new barrel properly fitted will solve the problem. If the slide locking lugs are also damaged, then you have to replace the top end. Putting a new barrel into a slide that has rounded, setback or otherwise damaged locking lugs will only damage the new barrel, wasting your money.

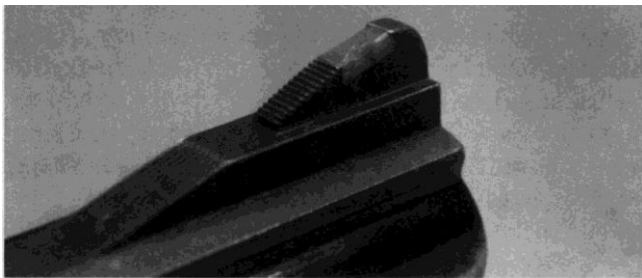
Look at the barrel bushing. Some bushings are cast of soft metal, and the locking lug will deform against the harder slide. If it hasn't already, then in short order the wear will harm accuracy. A new bushing solves this problem at low cost.

Are there cracks in the frame? Many shooters worry about visible cracks, though some do not matter. A crack in the dust cover over the recoil spring is not a concern unless it is extensive, or you are planning to mount a scope right there. This common crack results from contact between the top edge of the dust cover and the slide. Many shooters feel that since the stress between the dust cover and the slide has been relieved by the crack, any problem has been solved. If, however, you still want to eliminate the crack, you must first file down the top of the dust cover to keep it from contacting the slide. Then have the crack welded. Another common crack, through the left rail at the slide stop cutout, is so normal and harmless that Colt actually incorporated it into the design when they began machining the cutout hole completely through the rail.

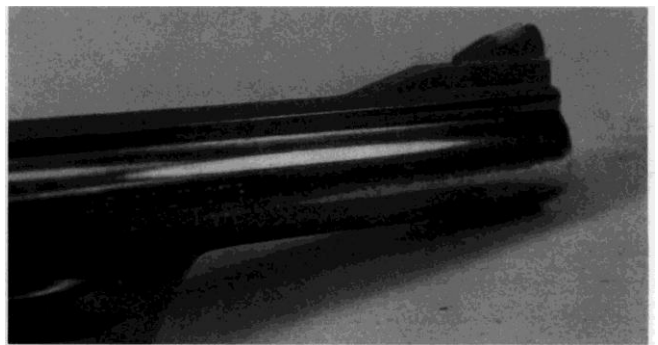
Buying a used revolver

Buying a revolver, single or double-action, involves pretty much the same process as buying a used pistol. First, assess the exterior to see if the revolver shows signs of hard use or abuse.

Look at the finish. Is it heavily worn or scratched? A used blued revolver will show white steel at the corners of the frame and cylinder. This wear is caused by holstering and drawing, and is normal. If the scratches look as if they were caused by a sidewalk instead of a holster, pass on this revolver. Or if you see scratches down to copper on a nickel revolver, pass again. A used revolver with a shiny new finish may have been re-blued or re-nickled, and needs close examination to determine its condition. Look at the screw holes. Are they oval? Not good. Incorrectly used, the fabric of a polishing wheel will reach down into the screw hole and dish it out. The proper, factory method of re-polishing requires fitting sacrificial screws to the frame. After the frame is polished, these screws are thrown away and new ones are fitted. Look also at the letters and markings. Do they look as if they are blurry? Blurry letters and markings in an otherwise shiny and good finish with good screw holes tell you that the polisher was careful. While he didn't dish the screw holes, he couldn't avoid “pulling” the markings. Blurry markings do not harm function, but should lower the price.



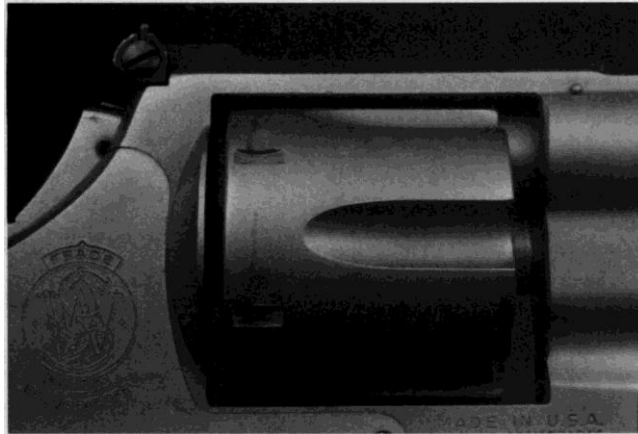
The front sight insert on this revolver is slightly dinged, but doesn't impair shooting. A front sight with bent and gouged metal has been dropped and should be inspected carefully before you buy it.



The bluing wear on this barrel came from the holster. A better holster will prevent this in the future. If it really offends you, have the revolver re-blued. It is just as accurate whether you blue it or not.

To determine if the revolver was ever dropped, check the muzzle, sights and hammer spur for dents and dings. In extreme cases, the sights will have been bent or broken completely off. A revolver with a dinged muzzle but a new front sight was dropped hard enough to break the sight, which was then replaced. Unless you can check barrel straightness and cylinder alignment before you buy, pass.

Look at the cylinder for these same dents and dings. If you see marks, gently open and close the cylinder. A dropped double-action revolver that lands on its cylinder can end up with a sprung crane. If you have to press firmly with a thumb on the cylinder to get the centerpin to click into its seat in the frame, the crane needs alignment. Straightening it is an easy operation.



The drag line of the locking bolt against the cylinder shows that this revolver is working properly. Revolvers will get this ring around them, there is no way to prevent it except by not turning the cylinder. Where's the fun in that?

To check function on the single-action revolver, first make sure it is unloaded. While holding the revolver with your firing hand, grasp the cylinder with your other hand and try to move it back and forth. A very small amount of movement is okay. If the cylinder moves more than the smallest fraction of an inch, however, you may have to adjust endshake after you buy it. Not a big deal. If the cylinder moves so much you can actually hear it clacking back and forth, buy this revolver only if it is cheaper than dirt, or you like a good re-building challenge.

Gently cock the revolver. In the old-style single-actions, (direct copies of the Colt SAA), you should hear four distinct clicks. Odd, tinny sounding clicks could mean weak springs or modified parts. Muffled clicks usually mean the action is over-oiled or greased. Gently cock the revolver through all six chambers. As you do this you must be sure to move the hammer slowly and deliberately to eliminate any momentum in the cylinder. Did the revolver fully carry-up, that is, did the cylinder come all the way up and lock? If it did not, the revolver may have a short hand or a worn ratchet. Though these problems are easy to fix, try to bargain the price down.

Do the pencil/firing pin test again, to make sure the firing pin is striking hard enough.

Look at the locking slots on each chamber. If they are burred or chewed up the revolver has probably seen too many sessions of fast-cocking shooting, or God forbid, fanning. Pass on that revolver.

Pull the center pin out, remove the cylinder, and look at the locking bolt. Is it beaten up? Are its edges peened? Heavy use, or just a bit of fanning and fast-draw practice will wear the locking bolt. While the bolt is cheap to replace, the cylinder is not. Heavily worn locking slots on the cylinder mean an expensive repair. Pass on the revolver.

Finally, look at the back of the barrel. If the forcing cone is caked in powder residue and lead, ask if it can be cleaned up. You need to see it. Check that the edges of the forcing cone are sharp. A worn or rounded edge means the revolver has seen lots of shooting. Is the rifling clean and distinct? Heavy use erodes the rifling as well as the edges of the forcing cone. A barrel with heavy wear in the forcing cone can be rectified by setting the barrel back and re-cutting the cone.

Cracks in the forcing cone cannot be fixed. Uncommon outside of magnum revolvers, these cracks result from the high pressure of the magnum ammunition stressing the edges of the forcing cone. Unlike wear, you cannot easily set the barrel back enough to fix a crack. With a cracked forcing cone it's much simpler just to replace the barrel.

With double-action revolvers you do all the same external checks that you did with the single-action revolvers. A significant percentage of the double-action revolvers available on the used market are ex-police revolvers. When police departments switched to automatics, they traded in or sold their revolvers. Pay attention to the details and you can get a good deal on a used double-action .38 or .357.

Many ex-police revolvers have the bluing rubbed off where they rode in a holster, but otherwise have little wear. Since many police departments qualify only annually, your revolver may have had only a couple of hundred rounds a year put through it! The grips, if original, will probably be very ugly. While the rest of the revolver was protected by the holster the grips were outside, getting banged by car doors, signposts, and who knows what. Grips are cheap and easy to replace.

To begin your mechanical checks, first release the cylinder latch and swing it open. Is the revolver loaded? No? Good. Swing the cylinder in and out several times. Make sure it swings smoothly, and closes easily. Smith & Wesson's binding while swinging usually means the sideplate screws have been switched. In other brands, it means the crane is dirty. If you have to press the cylinder to make it click when closing, the crane is out of alignment.

There are two checks for carry-up, one for single-action cocking and one for double. Single is simple. Slowly cock the action while watching the cylinder, just as you would for a single-action revolver. I do my double-action check very, very slowly, with my left thumb against the hammer, so when the trigger releases the hammer, the momentum of my trigger finger doesn't throw the cylinder into lockup. Although failure to carry-up can be fixed, you should bargain for a lower price because of it.

Open the cylinder and look at the forcing cone, on the back of the barrel. Give it the same thorough exam described for a single-action revolver.

Now look into the cylinder. At the front of the chamber is the shoulder. A magnum revolver that had a lot of .38 Specials put through it would have developed a crusty ring just in back of this shoulder. There can be corrosion under the ring. Ask to have any visible ring scrubbed out, and check the area for the pits that indicate too much time between cleanings. Pits can make extraction harder when you fire magnum ammunition, and actually rust if you use Specials. If the revolver has pits, don't buy it.

Check the back of the cylinder, at the openings to each chamber. If the revolver was used for competition, the chamber openings may have been chamfered to allow faster reloading during matches. Poorly done, however, chamfering makes ejection uncertain. Look at the work closely. Only the cylinder itself should be beveled. If the extractor star is also beveled, ejection may suffer. To check, you need to fire the revolver and eject the empties for at least 100 rounds. Since the cure for a bad chamfering job is fitting a new extractor, an expensive factory job, if you can't shoot the revolver beforehand or get a warranty pass on it.

Chapter 5 - Keep It Clean

Do you want to know the best-kept secret of the professional gunsmith? No deep learning, no years of practice, just one little thing to keep in mind: Ninety percent of the handguns that show up for work simply need a good thorough cleaning. And the rest of the problems? Most of them could have been avoided with one.

Rusted surface that requires re-bluing? Cleaning it after the rainstorm the last day of hunting season would have prevented that. Broken extractor? Maybe, if the chamber hadn't gotten so crusty that the extractor was stressed, it never would have broken.

Failure to feed in an auto? Groups getting so large that scores are dropping off? Scrub out the pistol, keep the bore clean and these problems won't occur.

In the early 1990's, when the Federal Bureau of Investigation went looking for a new pistol for their Hostage Rescue Team, they knew what they wanted. Custom gunsmiths who felt up to the challenge received a set of specs the size of a large paperback book and began toiling away, hoping to get the Bureau contract.

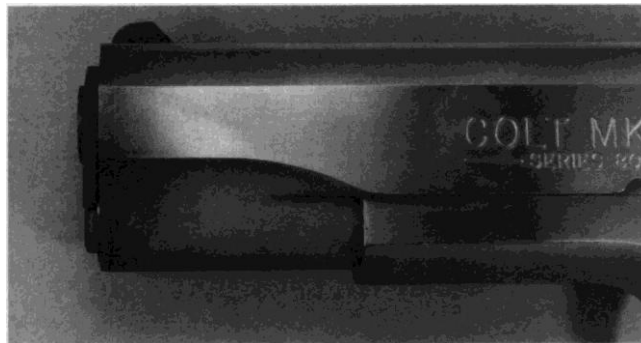
Each handgun had to pass a rigorous set of tests. One, naturally enough, was an accuracy test. Only it had a twist. After a normal check for accuracy, the FBI fired 20,000 rounds of Federal Hydra-Shok .45 ACP through each pistol — without stopping, and without cleaning. Whenever the pistols became, no kidding, too hot to handle, the testers sloshed them around in a trough of water and continued shooting. At the end of the 20,000 rounds, they tested the pistols for accuracy again. Not all made the cut.

You are not likely to need a pistol this sturdy or accurate, nor are you likely to try this test. Should you want to, be warned! At current wholesale the ammunition alone will cost you over \$10,000!

So, how to clean it, and when to do it?

A friend of mine, who stayed in the Marine Corps long enough to buy a set of gas stations when he was discharged, believes in cleaning firearms every time they are used. Seems like a lot, but the Marine Corps training he received, combined with his own biology convinced him that every time was the way to go. His biology? Yup. He is one of those unlucky individuals whose perspiration corrodes steel right away. He once rusted a 1911 through a hard-chrome job. If I hadn't seen it, I wouldn't have believed it. With sweat like that it isn't any wonder he believes so thoroughly in cleaning. He probably sympathized with the creature in the movie "Alien," too.

I only wonder how he managed to survive 12 years in the Corps.



This Colt 1911 is very dirty from a range trip, and has a large thumbprint right on the "C." Depending on the owners perspiration, this thumbprint may be a cause of rust. The pistol should be cleaned.

Since I am one of the lucky ones whose perspiration doesn't seem to rust firearms at all, my cleaning habits are a little less compulsive. If I have the time, and remember to do so, I'll clean my pistols as soon as I get back from shooting them. If I don't, I don't — um - sweat it. But quarterly and annually, depending on how much I shoot a pistol, they all get a check, and cleaning if needed. In season, the competition guns get cleaned a couple of times a week. That schedule works for me. Only you can determine the right schedule for you and your guns, but keep in mind that very first fact: Ninety percent of "broken" pistols just need a good, thorough cleaning. You can hardly clean too often.

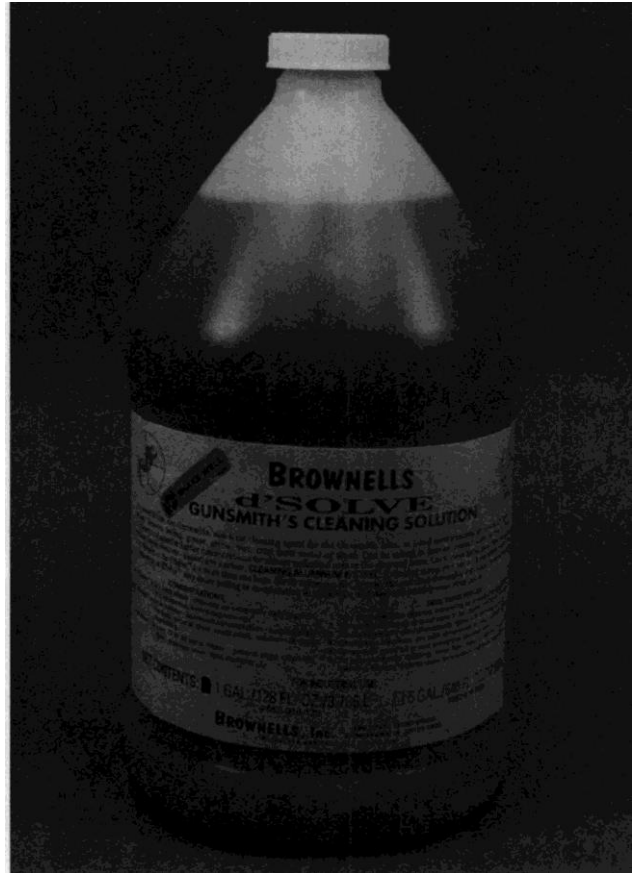
Before we discuss the specifics of disassembly and cleaning, let's begin with an overview. If you've made a workspace in a well-ventilated corner of the basement or the garage, you can set up a basin and tub arrangement right by your workbench. If you're using a closet or a corner of commonly-used room, you will have to clean your guns elsewhere. Gun scrubbing chemicals, even "odorless" mineral spirits, smell. "Elsewhere" means out of the house. Don't think you'll scrub a gun in the kitchen sink "just this once." Don't tell yourself no one will know because there's an open window right over the sink. What if you spill chemicals onto the floor inside your home? Or drop a part down the garbage disposal? Not good.

You need a bench on which to disassemble the handgun. This can and should be the same bench on which you plan to do the rest of your pistolsmithing. For the regular pistolsmithing you need a hard surface, to prevent your bench from soaking up oils, solvents and God knows what. For cleaning, though, you want to have a padded work surface. Simply get a separate mat that can be rolled or hung up out of the way of your regular work. Outers makes a soft mat that's perfect. Available in two sizes, it is soft enough to keep from scratching the pistol and its parts, but tough enough it won't get torn to shreds from use.

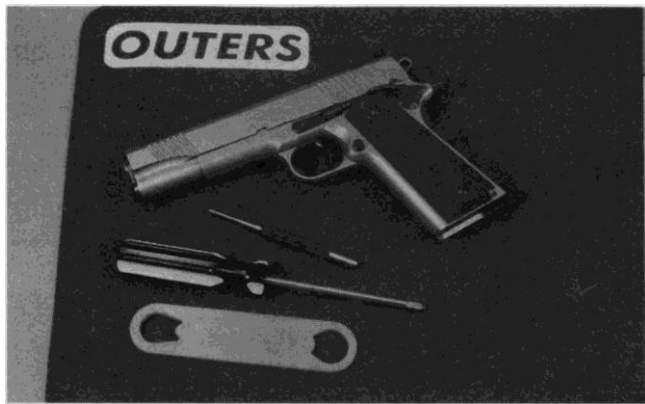
You can get by with carpet samples, edged so they won't unravel, but the larger weaves let the smallest gun parts disappear into the carpet. You'll be more successful with the right tool for the job.

You'll also need a large basin or old sink, braced at a convenient working height. If you're using a sink put a stopper in the drain. The stopper prevents a dropped part from disappearing down the drain.

I have found that using a small basin inside the larger sink is the best way to clean handguns. With a small basin I can use a small amount of solvent and still be able to immerse the parts. The larger sink contains any splashes while I'm working, and afterwards I just scrub the sink clean. I save and reuse the mineral spirits, pouring them back into their gallon can. If you're doing high volume cleaning, you might find this method hard on your back, but for once a month or even once a week, it works just fine.



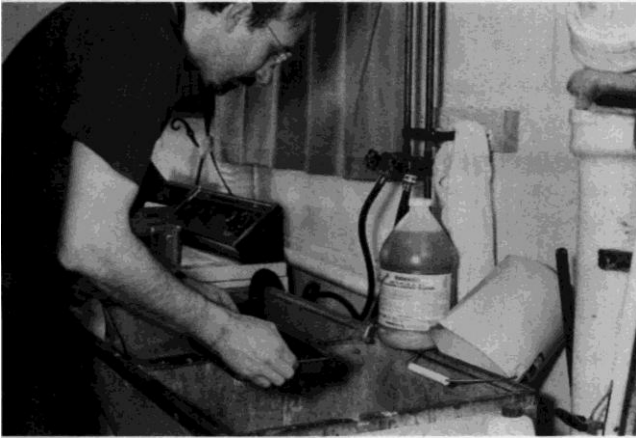
If the odor of even "odorless" mineral spirits is too much for you, Brownells d'Solve is a water-based cleaning concentrate. Completely odorless, this gallon will make enough solvent to scrub a hundred handguns.



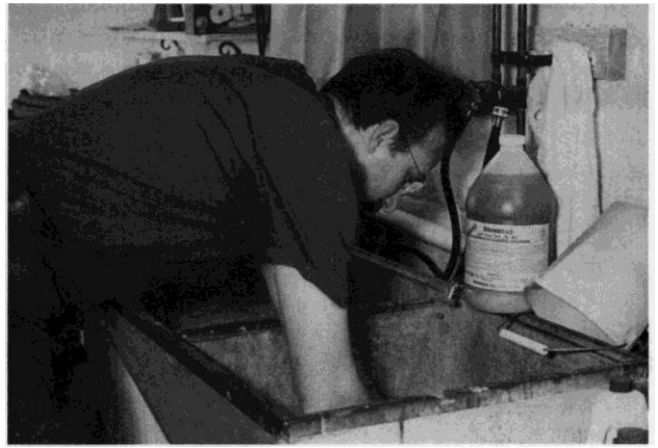
A soft mat on the workbench will protect your handguns finish. The dark matte finish of this Outers mat will also protect your eyes from the glare of bright lights.



If you don't have a parts tank, a small pan can do to clean your handgun. Disassemble it and pour in your mineral spirits or Brownells d'Solve.



Put the plug in your laundry sink, and scrub away to your heart's content.



The only drawback with the laundry sink method is the bending over. Shorter shooters may not have this problem.

If you'll be cleaning a lot of handguns an auto parts washer works well. The washer consists of a sink which sits on a drum of solvent (generally mineral spirits) and filtering water. An electric pump brings the solvent up into the sink. You dump the parts into the sink, grab a brush and start scrubbing. Check with your local waste carrier for disposal of the exhausted solvent.

With either the high-volume or low-volume home systems, if you have to use other solvents on the bore, apply them and let them soak in while you are scrubbing the rest of the pistol. Scrub the bore in the mineral spirits last.

Though it may seem like a big job, devising a basin and sink combo for cleaning your handgun (or entire collection) is pretty straightforward. Police departments, on the other hand, have to clean really large numbers of firearms on a regular basis.

To clean in large volumes quickly and easily, L&R has developed a series of ultrasonic cleaning tanks. Police departments love them, and no wonder; they work almost like magic. You just take the grips off your pistol, so the solvent can get to all the parts, open the action, and place the handgun in the tank. Close the lid, flip a switch, and come back after the paperwork and coffee have been finished. Presto, a clean pistol.

Sound too good to be true? Close.

The cleaning tank is great, no doubt about that, but what it produces is a pistol that is degreased, not one that is completely clean. There may still be copper in the bore, even if the department uses the ammoniated solution instead of the plain. It is also very likely there will be lead fouling. Any copper or lead deposits must still be removed by brushing.

There's another catch, not significant for a police department, but big for a home shop. A tank that will handle one handgun runs just over \$700. The concentrated solution, enough to make eight gallons, costs just over \$50.

Finally, since the tanks thoroughly degrease anything put in them, if after cleaning you don't properly and immediately oil your handgun, it will rust. L&R includes a water-displacing lubrication bath to re-lubricate the now-dry pistol.

The unit comes with complete instructions for setup and operation. You will need four or five feet of bench space to set up and operate the system. If you don't have this much room always available, you will have to store the units on a shelf or in a closet.

Mix your solution. Should you use the ammoniated cleaner? No. It cleans slightly faster, but the heavy ammonia odor requires much greater ventilation than the standard cleaner. The extra cleaning isn't worth the hassle of the odor.



A parts washer with a pump to send solvent through, and a compressor. Essentials for the professional, luxuries for the home.

The cleaning solution comes as a concentrate. Mix one part of the concentrate to seven parts clean fresh water. The easiest way to do this is to take a used water bottle and measure the side. Divide its height by eight, and mark the side of the bottle that far up from the bottom. Pour in concentrate to the mark, then fill with water.

Pour enough cleaning solution into the tank to cover your handgun when it is in the basket.

Take the grips off. For pistols, remove the slide and recoil spring. For revolvers, remove the grips and the crane and cylinder. The vibrations of the ultrasonic cleaning may cause smaller parts to shift. To prevent this, if you remove the sideplate for a thorough cleaning also detail strip the action of your revolver.

Place the parts in the cleaning basket and suspend the basket in the solution. If your parts are not completely covered, add more solution. Put the lid on it. Turn the unit on and clean for 10 minutes. Some models have timers and a heating unit. Set the timer for 10 minutes. For units with a heater, turn the heat on when you start, and turn the heat off when you are done. You do not need to pre-heat the solution.

When done, pull the basket out of the pan and drain it in your sink. Rinse with hot water. If you have compressed air, blow dry.

Put the parts back into the basket and place the basket in the auxiliary pan. Add enough water-displacing lubrication solution to cover your parts. Take the pan and basket, and place it on top of the ultrasonic tank so the pan bottom is slightly immersed in the solution of the main tank. This provides contact to transfer the ultrasonic vibrations from the main tank to the auxiliary pan.

Turn the machine on and run it without heat for 10 minutes.

The L&R lubricant will displace the water left in the nooks and crannies of your handgun. When done, drain the lubricant back into the pan. The more you drain, the faster the handgun will dry. Allow the handgun to air dry, Do Not blow dry. To speed drying, place the parts on a towel, and position a lamp a foot away.

The L&R ultrasonic cleaning did not remove metal fouling, it only loosened it. Once dry, use a brush and patches on the bore to remove the fouling. Lubricate as usual.

There is no arguing with the convenience of the L&R Ultrasonic cleaning system. If you are willing to pay the going rate, you can save lots of time and hassle.

Whatever method you use, cleaning leaves you with dripping wet parts. You will have to dry them. Wipe the parts down with a dry towel, shop rag or paper towel, and leave them disassembled on the bench until they air-dry. Or, after wiping them down, set them in the sun-inside and out of sight, of course — so they can dry even faster. Professional gunsmiths use compressed air. A compressor with a hose and nozzle will blow the surface dry in a few seconds. A compressor, though, is noisy and expensive. Also, you cannot “blow off” mineral spirits indoors—even in the garage — without a hood and exhaust fan. Back in high school chemistry we used hoods to control the vapors we regularly produced. Lighted cabinets with sliding doors at the front and a fan at the back to draw the vapors into a filtration system, those hoods were great. But they are way too much for home use. If, working in a shed or garage in the country, you want to use compressed air, it’s easy enough to step outside and dry your parts. In the city, or a cluster of condominiums, stick with ordinary air-drying.

One fellow I know figured a way to “blow dry” his guns. For a couple of bucks he picked up a fan and a blow dryer at a yard sale. He built a drying chamber and hooked the dryer to one side of it. On the other he connected the fan, orienting it to exhaust right out of his garage. After scrubbing guns, he puts the parts in the chamber, closes the door and flips the switches. The blow dryer pumps hot air in to the parts, and the fan sucks the solvent-laden air outside. His parts are dry in five minutes.

Another way to blow parts clean, more expensive than do-it-yourself-blow-drying but cheaper than a compressor, is a used scuba tank with a nozzle attachment. One of the members of my gun club uses one to dry his handguns. Apparently when scuba divers buy tanks, they only buy new. No one wants to risk their continued breathing on used tanks. Used tanks are inexpensive and cheaply filled. The catch is, you have to be scuba-certified, like my friend, to get tanks filled. Instead, go to a welding supply shop. They can fill tanks with compressed air or nitrogen for you to use. The pressure will not be as high as the scuba tanks, but it will be high enough. The welding supply shop can also provide valves, hose and a nozzle.

Once the handgun is clean and dry replace the lubricants removed by the cleaning solvents and reassemble the parts.

What do you need to get started?

Get a cleaning rod, long enough to go all the way through your longest pistol barrel. Buy patches and brushes in your calibers. Buy cleaning solutions and lubricants. In really dirty firearms you may need some specialized cleaning tools that you will have to make. We’ll discuss these in detail later.



For home cleaning, a full-size cleaning kit is best. You can keep all of the items handy and ready to use.



For a trip to the range, stuff a compact cleaning kit in your range bag. This way you can handle minor cleaning problems without having to cut short your range trip.

The manufacturers of many pistols ship new handguns with some kind of cleaning rod. These work fine. The material of the rod doesn't matter. Aluminum is popular because it is light, rust-proof, and cheap. If you feel you need to use a steel rod because your aluminum ones bend when you use them, you have brushes and patches that are too tight.

If you don't have a cleaning rod just buy a kit. Inexpensive kits, either caliber-specific or universal, come with everything you need to start cleaning. I buy universal kits for my home and shop work, and range kits for my shooting bag. Since I never know when I will need one, I keep kits at almost every location I will be shooting, or working on, guns.

There are two styles of handgun brushes, bore brushes and action brushes. Both can be purchased in plastic, brass and stainless steel. Because Glock ships a plastic-bristled brush with their pistols some people believe that brass or stainless steel brushes damage the Glock rifling. To the contrary, Tenifer, the surface hardening of the Glock manufacturing process, is so hard it actually wears out brass or stainless steel brushes. Glock ships plastic brushes because they last longer. They're cheaper, too.

For really heavily leaded barrels, stainless steel brushes clean the bore more quickly than brass, and much more quickly than plastic. Some shooters are concerned that the stainless steel bristles wear the bore, but after many conversations with manufacturers I've found only a few barrel-makers don't like the idea of using the stainless brushes. Others don't think it makes any difference. Personally, I've used stainless brushes for decades, and I haven't seen any wear on my pistol barrels that I can blame on the brush. If you want to try stainless, but find yourself nervous, I recommend the Tornado brush. Instead of bristles, the Tornado brush is looped. The loops scrape the bore without poking it, reducing the possibility of any wear. One shortcoming of the Tornado brush, due to its wound design, is that it doesn't scrub the corners of the grooves very well. After a few passes I switch to a brass-bristle brush to make sure I get into the corners.

Bore brushes should be the correct size for your caliber. Using a .44 caliber brush on your .357 will not clean the pistol faster, but it will wear the brush out faster because you will be bending and breaking the bristles while cleaning. You can also bend your cleaning rod. The one exception to matching your brush size to your bore size is with a .40 caliber pistol. Since no one makes a .40 caliber brush, you must buy a .44 brush and push it through the bore.

Looking very much like a toothbrush, the action brush is used on all the other parts of the handgun. If you want, you can use an old toothbrush. Just make sure you are done with it in its original role! Like using a carpet sample for a bench mat, though, using a toothbrush for an action brush has a drawback. The bristles of a toothbrush are not as stiff as the bristles of the real thing. Again, the right tool is a good investment.



Outers makes a full line of solvents and lubricants, and the neatest items: Gunslick Redi-Patches and Gunwipes. These are pop-up patches already soaked with either a cleaning solution or an exterior wiping solution. Pull the patch out, use it and toss it in the trash. No need to drag bottles of solvent to the range!



Shooter's Choice makes a full line of solvents and lubricants. The Quick-Scrub III cleans and de-greases, and while expensive it works fast. Use it at the range, not at home in the rec room.



Break-Free makes bore solvent, and Break Free CLP. This is a cleaner, lubricant, preservative that I find so useful I have used nearly a gallon a year since it came out.



The old-fashioned way to clean a barrel requires rod, brush, patches and solvent. It still works, and it still takes time and elbow grease.

Cleaning requires patches. Little pieces of cloth that are used once and thrown away, patches, like brushes, need to be sized for your bore. I remember, as a kid, sitting up late at night after a day at the range, cutting old bed sheets into just-the-right-size cleaning patches. I have to assume that my father, having grown up in the depression, was reluctant to pay good money for little throw-away cleaning rags. As a result, it was a good long time before I actually bought patches. Store-bought patches are easy to use. You don't have to worry about hammering a too-big patch through the bore, bending an aluminum cleaning rod, or, worst of all, poking a steel rod through the patch and marring the bore. Commercial patches are specifically designed to provide proper scrubbing action against the bore. Cleaning is much easier when you buy patches the right size for your bore.

Brushes and patches by themselves are not sufficient to properly clean your handgun. You must also use cleaning solvents of some kind. The simplest solvents act to wash away what you have scrubbed free.

For a basic cleaning solvent I go through gallons of mineral spirits every year. Whether you've decided on a basin and tub or a pumped parts washer, mineral spirits do a good job of dissolving powder residue and gummy oil. As discussed in Chapter 3, always buy the pure, odorless mineral spirits, even if they are more expensive than the reclaimed industrial stuff. The odor of the "odorless" spirits is much less objectionable and much easier to wash off, justifying the higher cost. While mineral spirits are safe to use, they will dry out the skin on your hands. You may want to use hand lotion when you are done cleaning.

Basic solvents such as mineral spirits don't do anything for the lead or copper in your bore. For these you need a bore solvent. There have always been cleaning solvents formulated to dissolve the lead, copper, plastic and powder residue left behind in your bore and chamber. In the old days, the solvent of choice was Hoppes #9, with its distinctive smell and load of chemicals that we later discovered to be harmful to your liver. Now we have chemicals that are much friendlier to our body parts. They work better, too. Still, sometimes I wax just a little nostalgic for the old odor of Hoppes.

The reformulated Hoppes works just fine most of the time, but if you find that you have a particularly persistent bore-leading or copper-fouling problem, then a dose of an even more specialized solvent may be needed. Highly specialized solvents can come in liquid or aerosol form. Although the aerosol cleaners below, are easy (but expensive) to use, don't confuse the two. Many specialized solvents can cause etching. I recommend Shooter's Choice Copper Remover, Shooter's Choice Lead remover and Outers Super Solvent Copper solvent. They do a great job of removing deposits and do not etch.

After using any bore solvent, you must put a light film of protective lubricant on the bore. To do this, take a clean patch and put two drops of your lubricant on it. Run this back and forth through the bore for a couple of passes.

In the last 10 years, aerosol cleaners have joined the arsenal of maintenance gear. With an aerosol you can scrub and degrease all in one shot. Up at Second Chance, near Traverse City, MI, where clean guns are a must, high ammunition consumption is a social necessity, and shooters spend the week outdoors, cases of Gun-Scrubber, One-Shot and other cleaners disappear every day down barrels and into actions. The operative word with aerosols is “outdoors.” Using these in the house is a really bad idea. Whenever they expect to shoot hundreds (or, in the case of Second Chance, thousands) of rounds, most shooters take a can along with them to the range, or to a match. Aside from their smell, the major drawback to aerosols is their cost. At home or in the shop, you can clean a hundred handguns with a gallon of mineral spirits. The same money spent on aerosols may clean a dozen.

Remember, if you use mineral spirits, solvents, or an aerosol cleaner any time in the cleaning process, you must lubricate all the now degreased parts.

An ideal firearms lubricant reduces friction, prevents water from reaching the steel, and keeps dust, crud and powder residue from adhering to the handgun. It does not react to the hot gases produced by the burning powder, or come off on your hands, your clothes, paperwork, or anything else you touch. And it does not chemically change over time.

If you're thinking “I know, I'll use WD-40,” stop right there. Do not, repeat, do not, use WD-40 as a firearms lubricant. I know that it is found in millions of homes around the country, and we all have countless uses for it, but lubricating handguns should never be one of those uses. WD-40 is formulated to be a water-displacing oil mixture. The more volatile portion of the mixture gradually evaporates, so if you lube a handgun with it, and leave it alone long enough, the remaining oils in the mixture harden. The hardening WD-40 glues small parts together so tightly that they cannot freely work, rendering the firearm inoperative. If this were not bad enough, the hardening mess collects any dust and lint around, and incorporates these into the solidifying gunk. If you've abused your handguns with WD-40, you'll need paint thinner to dissolve the lacquer between the parts. Don't use paint thinner inside. The odor is just too strong.

WD-40 has many useful functions, but not for firearms.

I have found two very useful lubricants in Break Free and FP-10. Break Free is a teflon-based lubricant. It has a liquid teflon base, and teflon micro spheres which act as mechanical lubricants. I use either one on all my firearms. Inside, on the bearing surfaces, both keep the parts well lubricated. Outside, after degreasing, they protect the exterior from water and prevent rust.

FP-10, a lighter lubricant, is useful during our Michigan winters. If you hunt, FP-10 will keep parts ready to go during a cold deer chase or a frigid afternoon of lying out in a goose blind. If you compete all winter, as we do at my club, switch to FP-10 when you start having trouble keeping your hands warm. Just as we once changed oils in our cars from summer to winter, using lighter lubricants in our guns during colder weather assures their continued good performance.

When you oil, you need to know how much oil and where to use it. Between the wars, Smith and Wesson had an advertising campaign for their revolvers, entitled “Seven Drops of Oil.” Diagrams showed seven spots, and told how often each one needed its drop. I tend to use more than seven drops, but my handguns come out of a solvent tank, and are completely dry.

Cleaning

In all the explanations of cleaning, I will start out by telling you to make sure the handgun is unloaded. I know, I know. I am being repetitive to the point of growing tiresome. But I know something else, too. With 20 years' experience behind the counter at various gun shops, I have lost count of the number of loaded firearms that have been handed to me. In almost every case, the hand-off was accompanied by the phrase, “Don't worry, it isn't loaded.” I have always checked. I will always check. Seeing the chambered cartridge clatter across the counter generally gives the careless owner some of that ol' time religion, but for how long, I don't know. Even if you are sure, absolutely and completely, that your handgun is not loaded, check anyway. It only takes a moment.

A simple cleaning is like a trip to the fast-lube

oil shop. You wipe or scrub the powder residue off of the frame and slide, without taking the frame apart. The only thing you do to the frame in the way of disassembly is to take the grips off. You scrub the bore of your barrel, and the cylinder if you are cleaning a revolver, until they are clean. If you are using dirty ammunition that leads your bore, even a simple cleaning will involve lots of barrel scrubbing. You should do a simple cleaning after every trip to the range.

A detailed cleaning is your trip to the service station. Instead of simply having your oil changed, you have your mechanic (in this case, you) look over all the fluid levels, check the brakes, the battery and rotate your tires. The detailed cleaning of your firearm involves completely dismantling the slide and frame. Some parts of your handgun, such as the firing pin of a double-action pistol, you will leave assembled, partly because they never need service, but mostly because it takes specialized tools to dismantle them. You should do a detailed cleaning of your firearms on a schedule, just as you do your car. Every 1,000 rounds is a good rule of thumb.

An aside here. Barrels are not alike in their cleaning requirements. A match barrel will be easier to clean than a factory barrel because of its harder and smoother bore surface. The rougher surface of a factory barrel will build up lead and copper deposits more quickly, and require more scrubbing to come clean. A lightly pitted bore will lead quite quickly, and require a good deal of scrubbing to clean.

Cleaning the 1911

So. Before you begin cleaning your 1911, check to see that it is not loaded. You'll have to decide whether your pistol needs a detailed cleaning or a simple cleaning. Remember the mantra, "Simple every time, detail every 1,000." Have you fired 1,000 rounds since the last detailed cleaning? If not, then a simple cleaning will be sufficient.

In this cleaning description, and all those that follow, I will be describing how a right-handed person handles the handguns when cleaning. The process of disassembly, cleaning and reassembly involves juggling the parts, and rotating them on almost every axis. If you are a left-handed shooter, you will have to make adjustments during cleaning, as you do in the rest of the dexterous-oriented world around you.

In a simple cleaning of the 1911, dismount the slide assembly from the frame. Pull the recoil spring and assembly if any, out of the slide, and remove the barrel and bushing. Scrub the bore with a bore brush for several passes, starting with a Tornado brush if the leading is severe. Swab the bore with a bore solvent and set it aside while you work on the rest of the parts.

Wipe the powder residue off of the bushing, the recoil rod if you have one, and the slide. On the breech face and around the extractor the powder residue gets packed hard enough that you will have to use your action brush to loosen it.



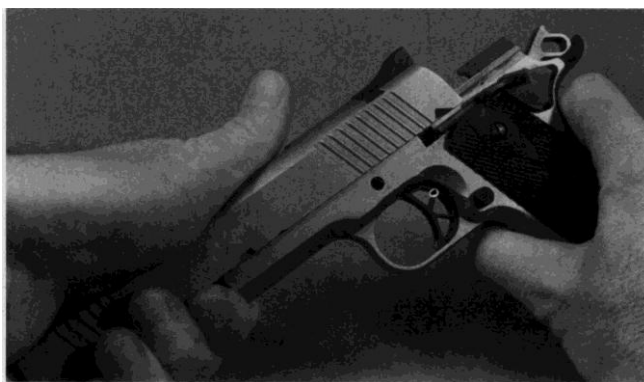
Starting with an empty pistol, hook the left thumb in the trigger guard and pull the slide back until the smaller notch lines up with the slide stop.



With the disassembly notch lined up to the slide stop, push the slide stop out of the frame with the tip of your right forefinger.



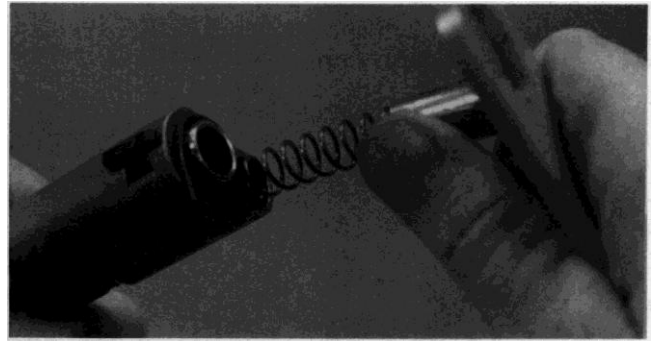
1911 pistols such as this Kimber, that have a recoil spring guide rod, are easy to pull apart. The rod will keep the spring under control until you later turn the bushing.



If your pistol does not have a recoil spring guide rod, curl your fingers underneath and control the spring as you pull the slide off.



Use the bushing wrench to push the retainer down, and rotate the bushing to the right side of the slide.



Use the bushing wrench to keep the recoil spring under control. Ease the spring and retainer forward.



One-piece rods are removed from the rear, after the recoil spring and retainer are slid out the front of the slide.



Turn the bushing to the left side of the slide before removing the barrel.



Pull the barrel out of the slide, pushing the bushing with it.

Check the barrel once you are done with the slide. Brush the bore again, run a dry patch through it and inspect it. Is there still lead in the corners of the rifling? Scrub it again. Use a bore solvent. When done, set the barrel down while you clean the frame.

Take the grips off the frame. Wipe the powder residue from the frame. Around the barrel seat (the part of the frame where the barrel rests when unlocked) the powder residue may be packed in place, as it was on the breech face. Brush here with the action brush to loosen the powder residue, and wipe it away. Wrap a cleaning patch around your action brush and wipe the inside of the magazine well clean.

If you had to brush the barrel out and soak it a second time, check it again. Does it still need scrubbing? If the answer is yes, and it hasn't been very many rounds since your last cleaning, you may be wondering why. The fault may not lie with your scrubbing, or your bore.

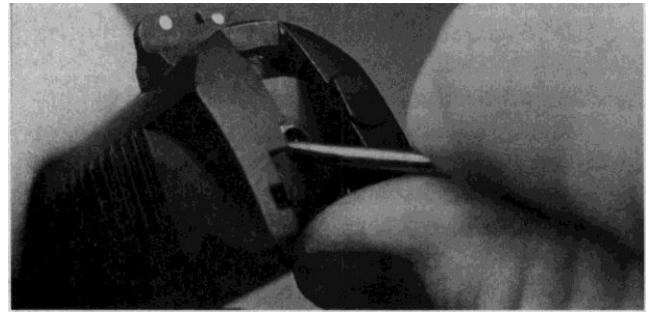
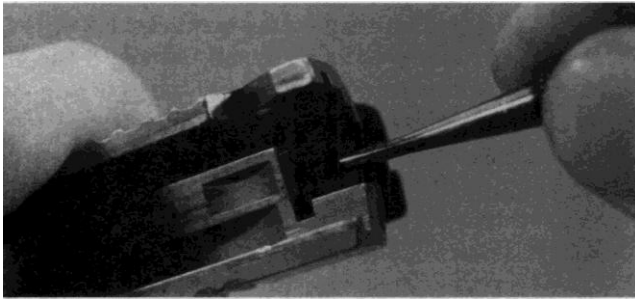
Have you recently switched brands of bullets? Some shooters find after a practice session of only several hundred rounds that a new brand of bullets will lead significantly more than the old brand. In a severe case the bore can look more like a section of sewer pipe than a pistol barrel. Start out with the tornado brush, and brush for a dozen passes or so. Run a patch of specialized lead solvent into the bore and let it sit for 10 minutes. Run a dry patch down the bore, and then brush with the tornado brush again. Once the lead is mostly scrubbed out, and remains only in the corners of the rifling grooves, switch to a bristle brush. Alternate between the wet and dry patches, and the bristle brush, until the bore is clean. And switch back to the previous brand of bullet.

If you're noticing heavy copper fouling, use the plastic brush to loosen powder residue, then wet a patch with a copper-solvent bore cleaner and run it through your bore.

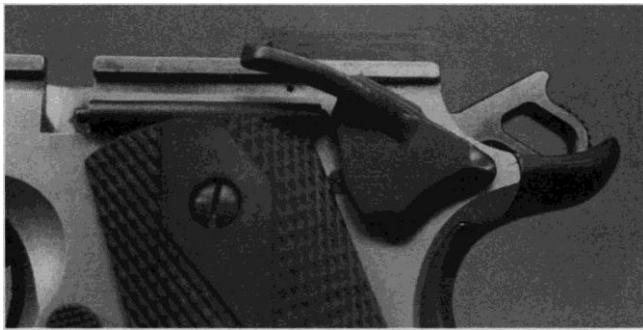
Let it sit for 10 minutes, then run a dry patch, plastic bristle brush and a wet patch again. As it dissolves and reacts to any copper deposit on the bore, copper solvent turns the patch blue or green. This is why you must use a plastic, or, in the case of very heavy copper fouling, a stainless steel brush. If you use a copper or brass brush, the solvent will react to the presence of the brush, and you will never see a "clean" patch. Continue the process until the patches come out without any green or blue on them. Copper solvents are very aggressive. You must not leave them soaking in your bore for more than the recommended time or they can etch it. While the etching may not have any effect on accuracy, longevity or service life of the barrel, who wants to find out the hard way?

Once the barrel does not need any more attention, you are ready for oil and reassembly.

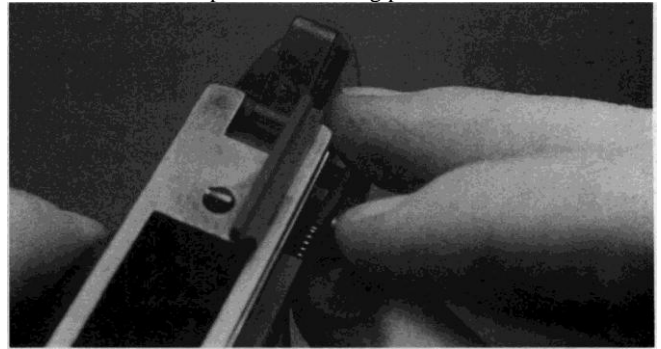
Oiling should be done sparingly. You need a drop of oil on the barrel at the muzzle, the link and the upper lugs. If you have a recoil spring guide rod, place a drop of oil on it after the spring is in place. Before you put the slide assembly back on the frame, put a drop of oil into each rail on the frame. After reassembly, wipe the exterior with a oily cloth.



To remove the firing pin and extractor, push the firing pin into the slide..... and push the retaining plate down.



To remove the thumb safety, cock the hammer and place the safety at the halfway point between "on" and "off." Then lift the safety out from the frame.



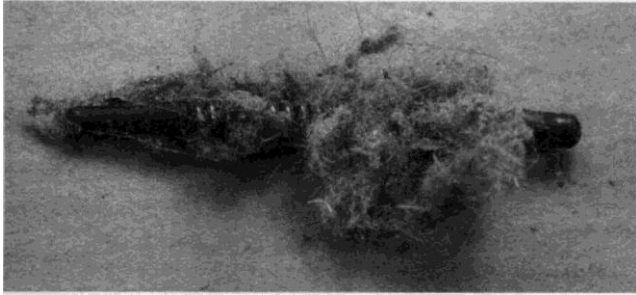
When you pull the thumb safety out of the frame, keep a fingertip over the back of it. This prevents the spring and plungers from leaping to freedom.

In the 1911, a detail cleaning starts in earnest after you have finished with the barrel. Secure the front of your slide in the padded vise in order to remove the firing pin. Push the firing pin in with a drift pin, and, while holding your hand over the end of the slide, slide the retaining plate down. If you don't cover the end of the slide you will launch the firing pin across the room. Use a small screwdriver to pry the extractor out of its tunnel. Pull it completely free and set it down on the mat next to the other slide parts.

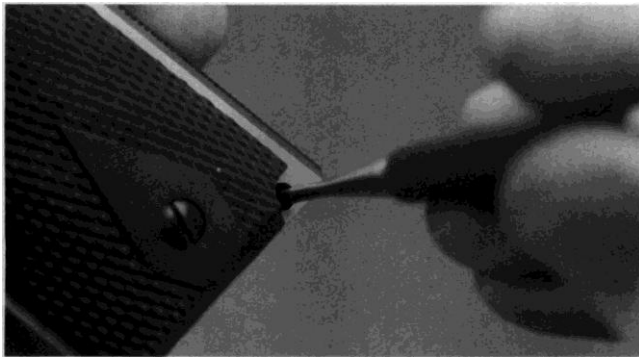
This job is a bit more detailed for the Colt Series 80 pistols. Hold the slide upside-down in the vise. Use one drift pin to push the safety plunger into the slide, and then use another to push the firing pin into the slide. Let go of the safety plunger. Let go of the firing pin and let it go forward against the plunger. The firing pin is now held in the slide. Remove the firing pin retainer. Push the safety plunger down, and the firing pin will come out. Take your small screwdriver and pry the extractor out a small amount. The plunger is now free, and you can lift it and its spring out with your hemostat. Finally, pull the extractor out of the slide.

Now that the firing pin and extractor tunnels are empty, you can scrub out the powder residue. Cut a bore patch into a small square, and use a drift pin to push it through the extractor tunnel. Take a .22 caliber brush and scrub out the firing pin tunnel. Wipe off the firing pin, its spring, the extractor, and in the Series 80 pistols, the safety plunger.

On the frame, cock the hammer and turn the thumb safety to a position halfway between "safe" and "fire", and lift the safety out of the frame. The safety won't come out if you don't first cock the hammer. Grasp the plunger that bears against the safety, and pull it out of its tube. This assembly consists of two plungers, one on each end of a coil spring, and it should be one unit. If the plungers come off of the spring the function of the pistol does not suffer, but it's awfully easy to lose track of the parts. Carefully set the assembly where you will find it again, and do not set other parts on it.



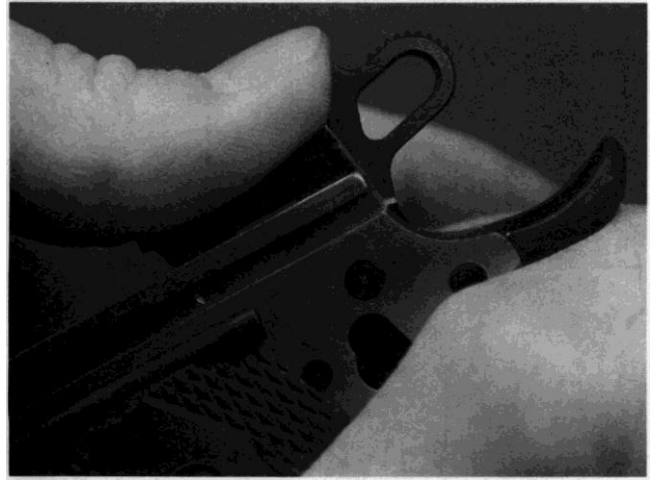
If you do not restrain the spring and plunger, it will leap free. This unit jumped under the furnace, and had to be swept out. Between the lint, dust, dirt and ant attached, I wasn't really sure I wanted it back.



Drift the mainspring housing retaining pin out of the frame

Ease the hammer fully forward. For cosmetics, grind a drift pin to match the cupped end of the mainspring housing retaining pin, located at the bottom rear of the frame. With your modified punch, drift this pin out. Slide the housing down and out of the frame. Lift the grip safety out of the frame. Push the hammer pin out, and lift the hammer out. Push the sear pin out of the frame, and lift the sear and disconnector from the frame. Turn the frame on its left side, and with a small screwdriver push the magazine catch partially out of the frame from the left side with your left hand. At the same time, turn the screw on the right side a quarter turn counterclockwise. When you hit the slot, the screw will turn and the magazine catch will pop out of the frame. Pull the trigger out of the frame.

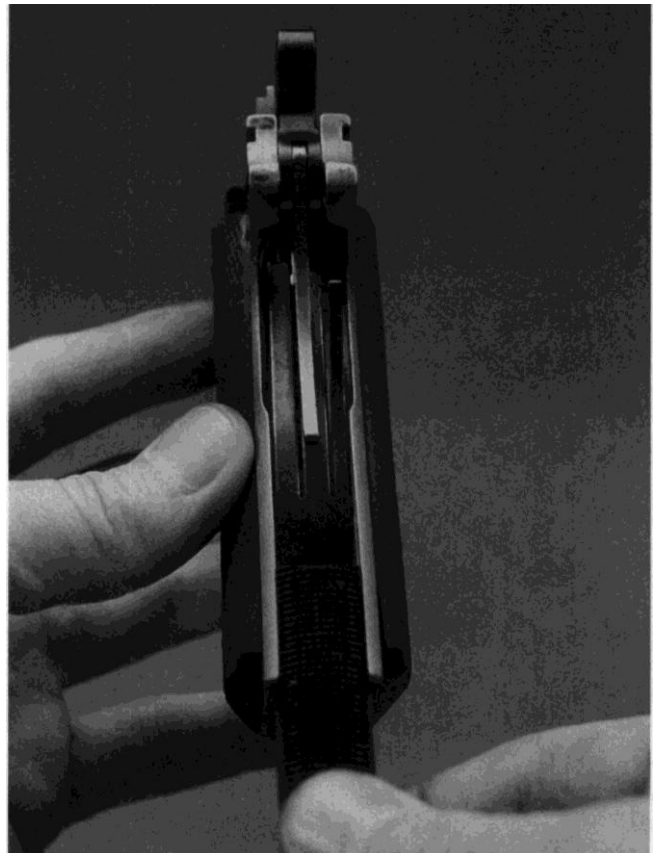
Scrub the powder residue out of the now bare frame. Be sure you reach down into the trigger slot with the narrow end of your brush, and scrub the powder, dust, and lint out of the hammer and sear recesses. Wipe or scrub the powder and dirt off all the parts you have pulled out of the frame.



Ease the hammer down to remove tension from the mainspring.



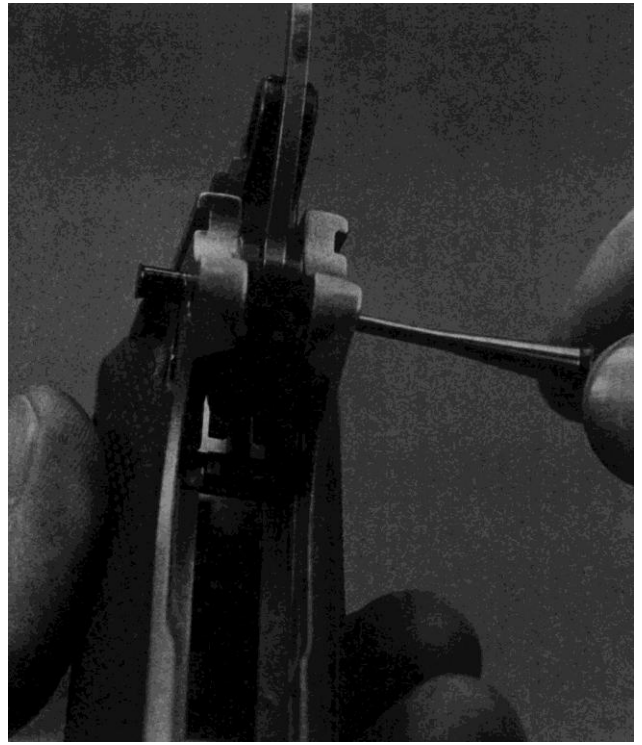
With the mainspring housing slightly lowered, lift the grip safety out of the frame.



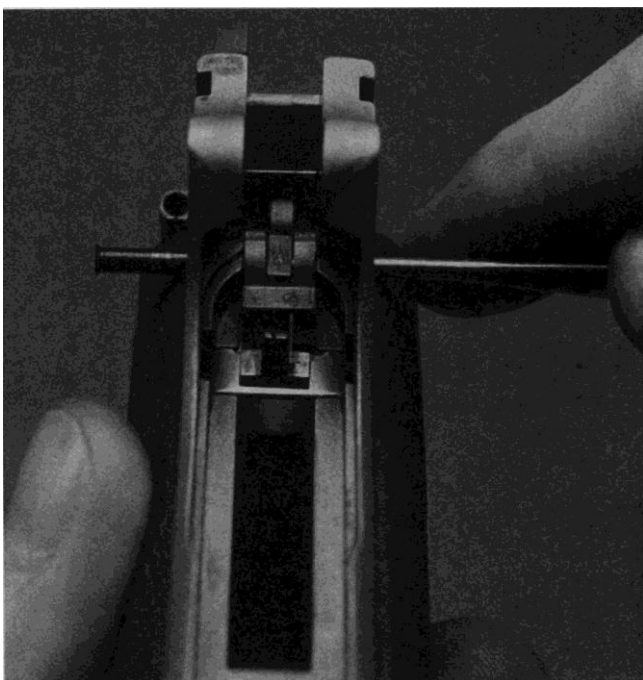
Slide the mainspring housing down out of the frame.



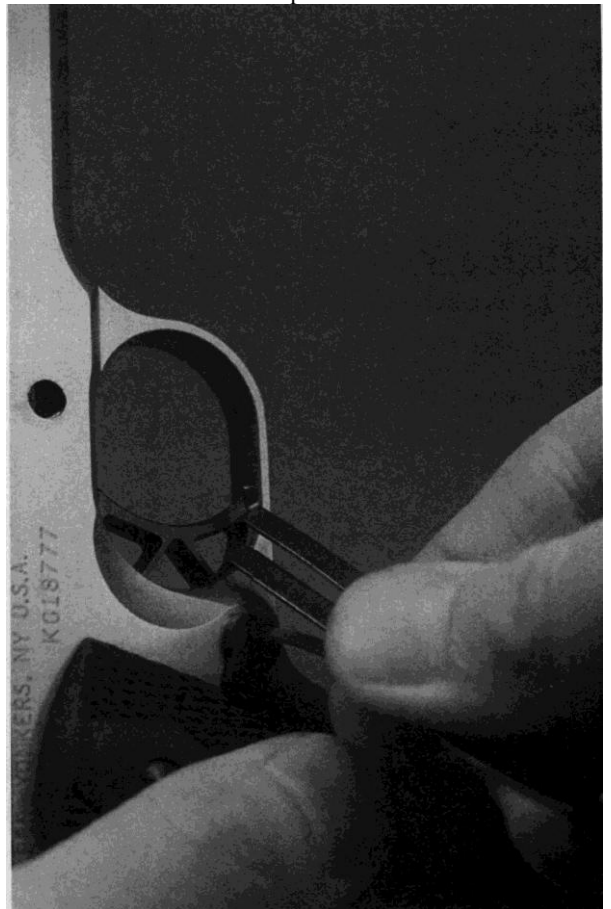
Lift the three leaf spring out of the frame.



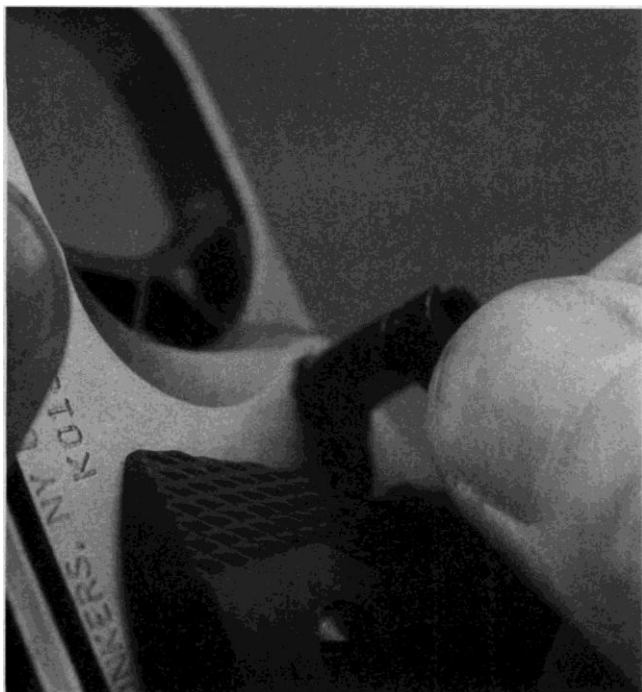
Push the hammer pin out of the frame.



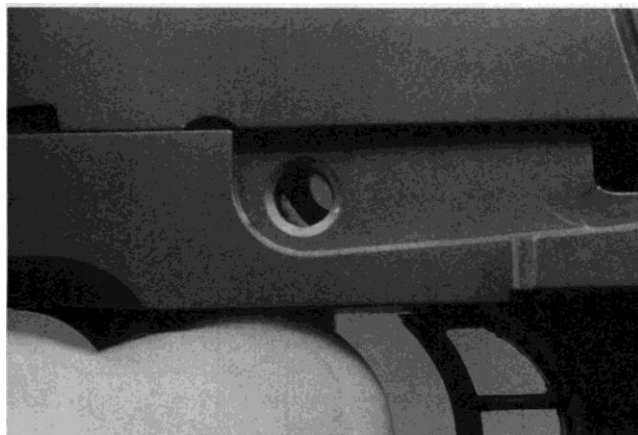
Push the disconnecter-sear pin out of the frame.



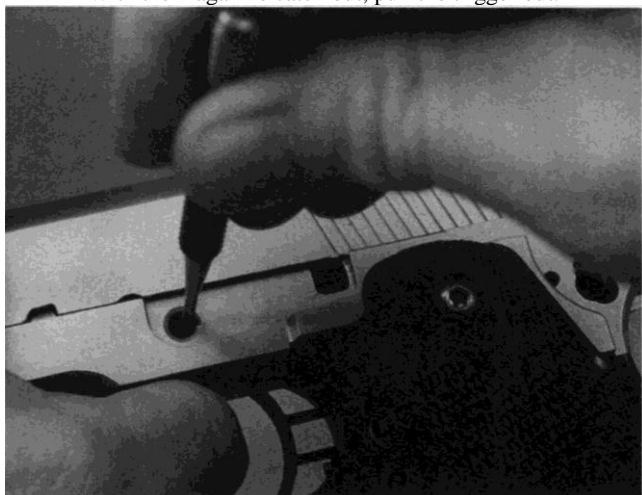
If you don't have a small screwdriver, the third leaf can be used to turn the magazine catch retainer.



With the magazine catch out, pull the trigger out.



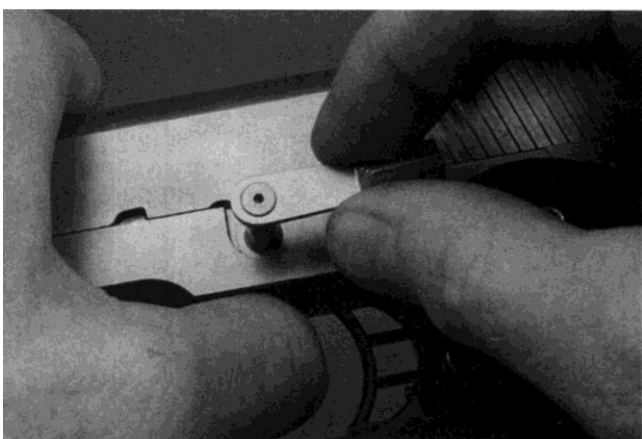
You must align the link to reassemble the 1911.



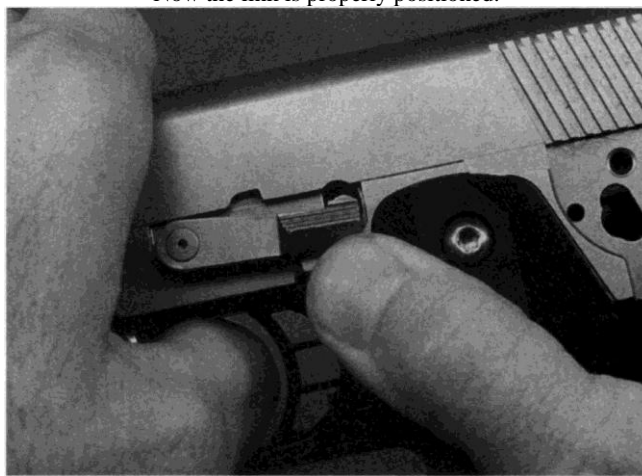
Use a drift punch to catch the link and line it up.



Now the link is properly positioned.



With the link lined up, place the slide stop in the frame.



Press the slide stop into place.

If you have used mineral spirits or an aerosol scrubber on the frame or parts, you will have to lubricate on each part as you re-insert it.

All the internal parts that move, including the hammer, sear, disconnect and trigger, get a drop of oil.

In the slide, place a drop of oil in the locking lugs if there are any, or on the edges of the ejection port if there aren't. The top inside of the slide, where the barrel rubs as the slide cycles back and forth, gets a drop of oil. The cam surfaces or link get another drop of oil.

To begin reassembly put the trigger back into the frame. With the trigger in, insert the magazine catch, and turn the screw clockwise while holding the mag catch slightly out of the frame. When you turn the screw into the frame slot, the magazine button spring will snap the magazine button back in place. To insert the sear/disconnector, hold the disconnector with a hemostat or needle-nose pliers, and place the sear in its correct position on the disconnector. Then reach into the frame and put the top of the disconnector in its hole and the bottom against the trigger bow. Let go of the pliers, and pick up a dental pick. With the pick, align the disconnector and sear pivot holes with the frame hole, reaching in from the right side. Finally, insert the sear pin from the left side.

For the Series 80 pistols, after you have pushed the sear pin through the frame far enough to hold the sear and disconnector, stick your left pinky down into the magazine slot. Approach from the top. Turn the pistol on its left side and hold the sear pin in place with your left thumb. With the hemostat, position the firing pin safety lever in place. Looking through the pivot hole on the right side, use the dental pick to line the lever up with the hole, and then push the pin through. Use your pinky finger to keep the lever from falling into the magazine slot while doing all this juggling.

Turning the frame back onto its left side, place the hammer in the frame, line up the hole and push the hammer pin through. Series 80 pistols, as usual, need a bit more juggling. Push the hammer pin in only far enough to catch the hammer, and then turn the frame upright. Check the trigger lever, just installed, to make sure it is down and bearing against the trigger. If you don't check, and the trigger lever is misaligned, you won't know until you try to fire the pistol. It won't fire. Insert the upper safety lever, and lining it up with the hammer pin hole, push the hammer pin through it.

Holding the frame with the front end down, flip the hammer strut up. You should now have enough clearance to install the three-leaf spring. Place its bent tab in the slot near the bottom of the frame, and check to see that the left hand leaf rests on the sear foot, while the center leaf rests on the disconnector bevel. Slide the mainspring housing up just far enough to capture the three-leaf spring. Swing the hammer strut down and place the grip safety into the frame. Make sure the hammer strut fits into the notch in the grip safety. There is a cup on the top of the mainspring housing. Slide the housing to capture the strut in this cup. Take a moment for a visual check of the back of the frame. Does everything look like it did when it was together? If so, then push the mainspring housing all the way up, and place the retaining pin into the frame and partially into the mainspring housing. You should be able to place the pin far enough into the holes by hand to keep the mainspring housing from falling out.

Check to see if you can cock the hammer. If you can, let it back down and drift the mainspring retaining pin in all the way. If you can't you probably have the strut out of line and jammed against the top of the mainspring housing. Pull out the retaining pin, pull the mainspring housing down a bit, and line the strut up again. Push the mainspring housing up, and try again. Cock the hammer again, insert the thumb safety plunger assembly into its tube, and start the thumb safety into the frame. As in removal, the hammer must be cocked to insert the safety. The plunger assembly will prevent the safety from fully seating. Use your dental pick to push the safety plunger far enough into its tube to clear the safety, and push the safety all the way home.

Reassemble the slide. Check the extractor for cracks or chips on the hook. Install the extractor. Look at the firing pin spring. Is it short, or broken? The minimum length for the spring is 1.650-inches. Is the firing pin straight? If not, get a new one. Although the bent one has been working, firing pins are not expensive, and there is no need to risk stressing the pin more by trying to straighten it. Install the pin and spring, push them into the tunnel and slide the retainer in behind them. Once together, check to see that the firing pin moves freely through the retaining plate's hole.

The Series 80 takes more work. Put the slide back in your vise upside-down. Push the extractor in place. Look through the plunger hole until you see the little shoulder on the extractor. Push the extractor back out until this shoulder clears the hole. Insert the safety spring and plunger in the hole, and holding the plunger down, push the extractor forward again to capture the plunger. Check to see that the plunger moves freely in and out. Pushing the plunger into the slide, insert the firing pin and spring. With a drift pin, push the rear end of the firing pin past the plunger. Let go of the plunger. Let go of the firing pin. The firing pin should now be captured by the plunger. Insert the retaining plate. Push the plunger in one last time. The firing pin should snap out to the retaining plate. Check the firing pin. You should not be able to push it past the plunger. Pushing in the plunger allows you to push the firing pin forward. The slide assembly is finished.

Assemble the barrel into the slide. Before you put the slide on the frame, place a few drops of oil on the rails. Perform the mechanical checks on buying a used 1911, explained in Chapter 4, to make sure you have put things back together properly.

Cleaning the Beretta M-92

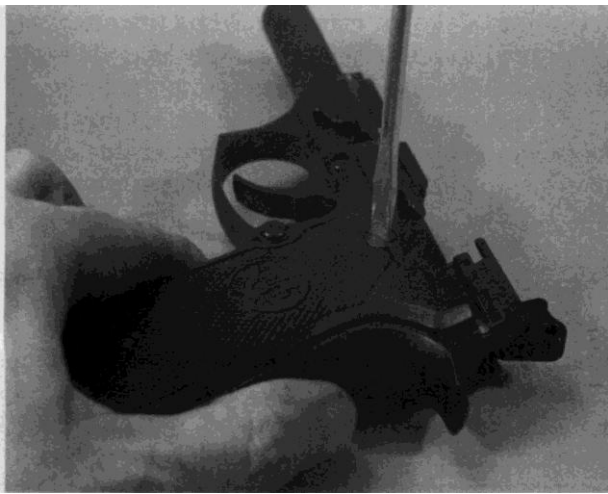
The Beretta 92 is quite easy to strip for simple cleaning. It is issued to the Armed Services, and the last thing a G. I. needs is a pistol he can't quickly and easily clean the mud from. After you check to make sure it isn't loaded, use the safety to de-cock the hammer. Remove the magazine. On the right side of the frame ahead of the trigger guard is a small button. On the left side of the frame is a lever. Press and hold the button into the frame. Pivot the lever down from the slide. You can now remove the slide and barrel from the frame.

Grab the rear of the recoil spring guide rod and push it toward the muzzle, lifting it from its seat. Since the rod and spring are not a unit, be careful not to launch the rod. With the spring out of the slide, look at the rear of the barrel. Find the small plunger. This unlocks the barrel from the slide. Push this plunger in, and lift the barrel up and out of the slide.

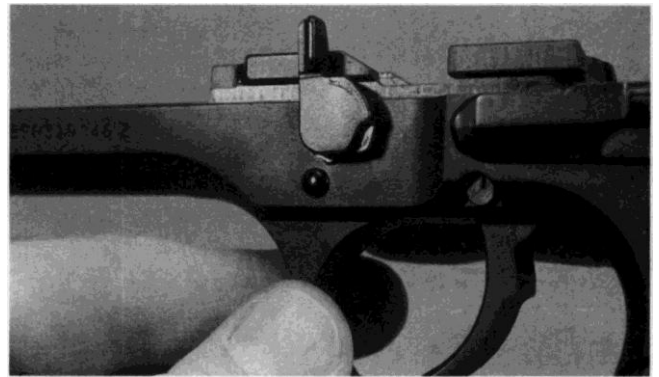
For a simple cleaning wipe off the powder residue, brush and use solvent in the bore. Lubricate the Beretta with a drop of oil on the front of the locking block. On the slide, lubricate the firing pin safety plunger. Once everything is clean and oiled, reassemble.

I have to confess that a detailed cleaning of the Beretta M-92, like any other double-action pistol, is a pain in the butt, and I skip it if I can. When your pistol needs more than just a simple cleaning, but does not yet require a detail cleaning, try the following: Take the slide off, and remove the grips from the frame. Immerse the frame in mineral spirits and let it soak for 20 minutes. Allow it to drip-dry and, if you can, finish drying with compressed air. Lubricate with Break Free. Break Free acts as a solvent for, among other things, powder residue. Work the action, and immerse the frame for another 20 minutes. Dry the frame, re-oil it and reassemble.

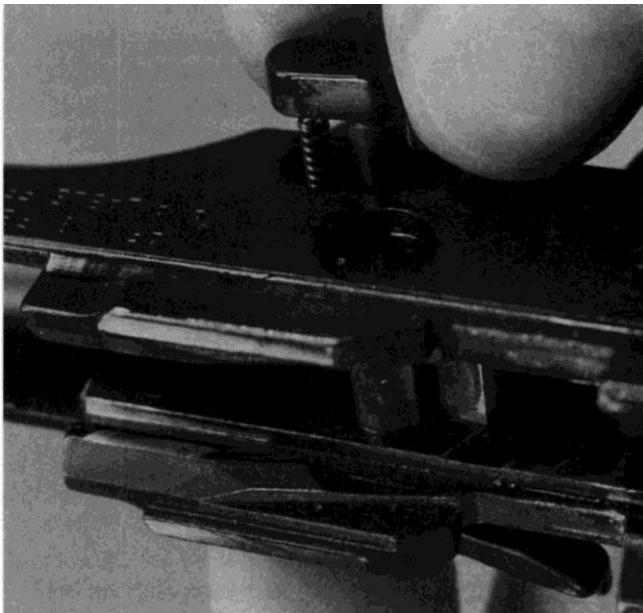
I admit this is not as thorough as a detail cleaning, but it will save you more than an hour of stripping, cleaning and reassembly. It will also postpone your need for a detail cleaning.



With the slide off, remove the grips.



To remove the disassembly lever assembly, pivot the lever until the arm points up.



Pull the catch and spring out of the right side of the frame.



(1) Pull the disassembly lever out of the frame.



(2) Before you remove the trigger bar you must remove the trigger bar tension spring.



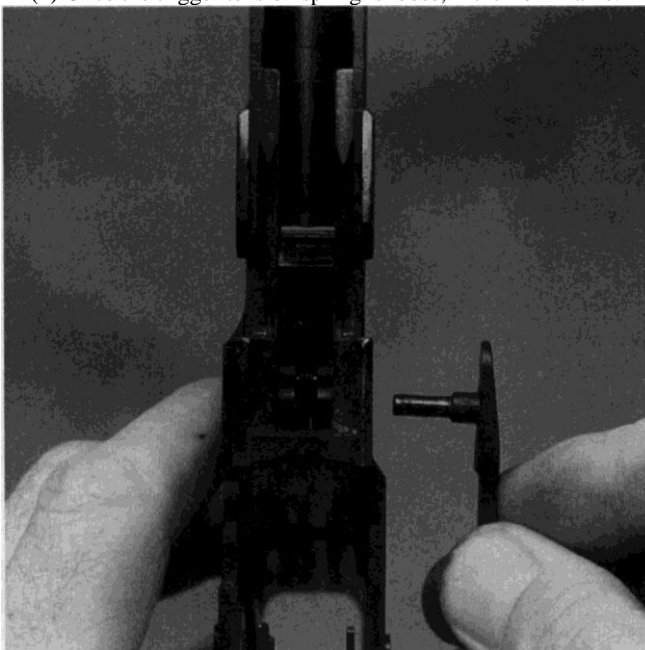
(3) Catch the edge of the spring with a screwdriver and gently pry it away from the trigger bar.



(4) Once the trigger tension spring is loose, lift it from frame.



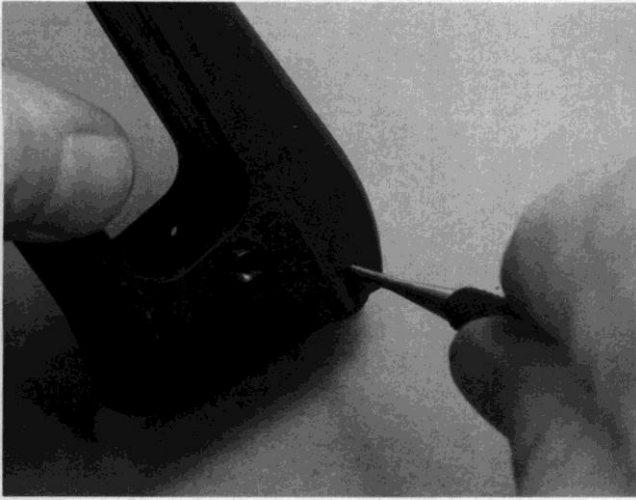
(5) Pinch the trigger bar with your fingertips to remove.



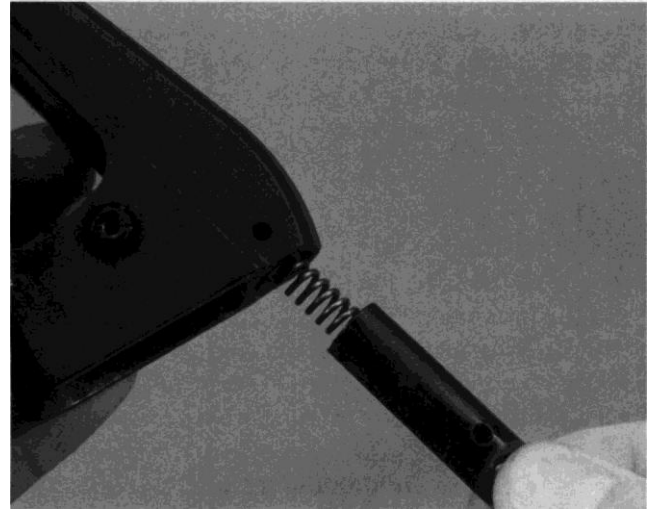
(6) Lift the trigger bar straight out of the right side.

Eventually, you will need to do the dreaded detail cleaning. Take the grips off. When you removed the slide, you rotated the disassembly lever down. Now, push the disassembly button into the frame and turn the lever the other way. Rotate it until the tip of it points straight up. Before you remove the trigger bar you must remove the trigger bar tension spring. Lift the disassembly lever out of the frame on the left side, and the disassembly latch button and spring from the right side.

Place the frame on its left side. With a small screwdriver, unseat the upper part of the trigger bar spring from the trigger bar. Lift the spring from its hole in the frame. Pull the trigger bar straight out from the frame. The trigger spring is difficult to replace once it has been removed. You do not need to remove the trigger, so don't.



Push the mainspring cap against the bench and push the retaining pin out with a drift punch.



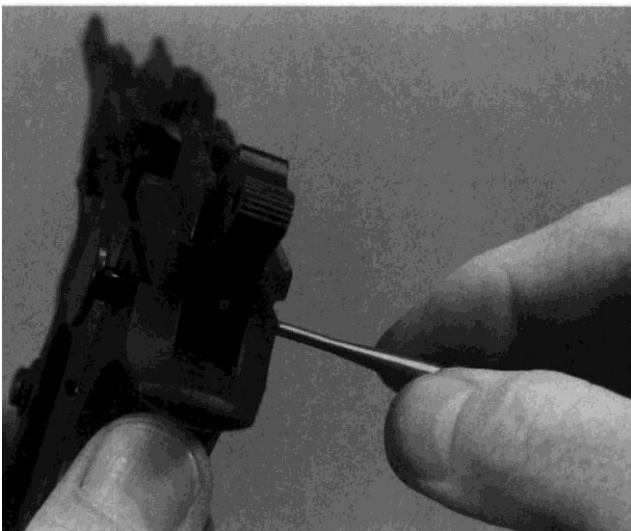
Remove the mainspring and mainspring cap of the Beretta M-92 from the bottom.



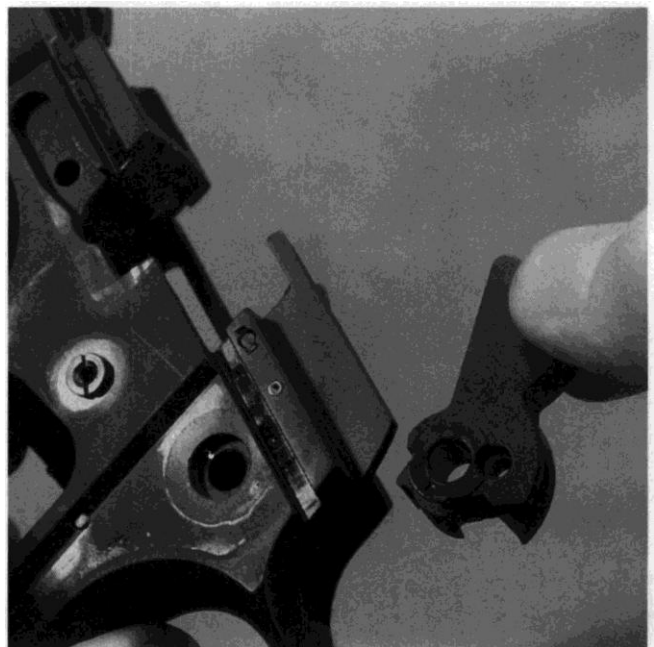
The current production Berettas have a larger hammer pivot pin head. The top of this head rides in a slot in the slide and prevents the slide from coming off the frame backwards.

The hammer must be down to disassemble the hammer and sear. Take a 1/8-inch punch. Hold the frame in one hand and press the lanyard loop against your bench. Use the punch to push the retaining pin from the frame. Ease the lanyard loop and mainspring out gently.

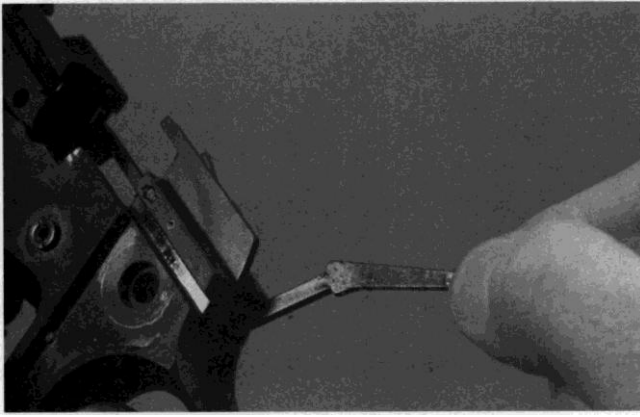
Push the hammer pin out from right to left. Lift out the hammer and hammer strut. For cleaning, you do not need to remove the sear. Removal of the hammer gives you room to scrub the sear and the other parts. If you are going to do a trigger job to the Beretta, you must remove the sear. The sear pin hole is the one directly behind the upper grip screw bushing. With a 3/32-inch punch, press the pin out of the hole and let the sear drop free.



Push the hammer pivot pin out from the right side.



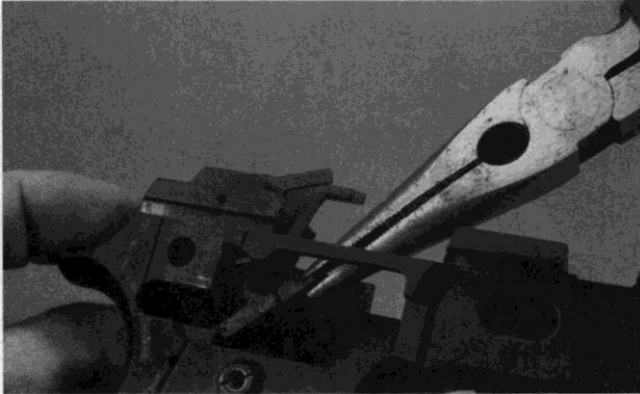
Push the hammer slightly forward as you lift it out.



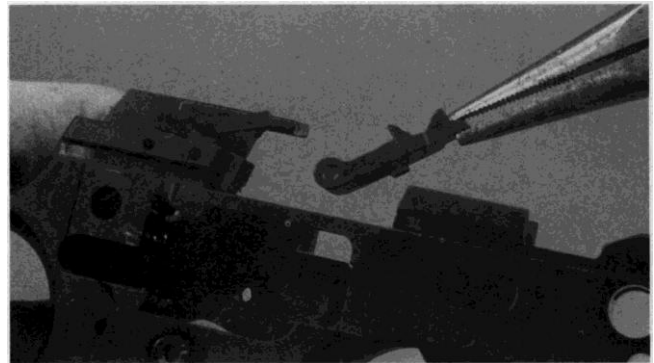
Lift out the hammer strut.



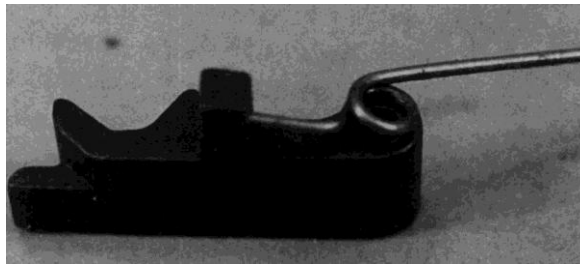
The sear pin is behind the right-side grip screw bushing.



Grasp the top of the sear with needle-nose pliers.



Once grasped, lift out the sear.



This is the correct relationship of the Beretta M-92 sear and its sear spring.

To reassemble, reverse the order. Hold the frame in a padded vise. Use a pair of needle-nose pliers to position the sear, and push your 3/32-inch punch through from the right side to hold the sear in place. Use the pliers again to position the sear spring, and push the punch through enough to capture the spring. Press the sear pin into the frame from the left side, and catch the spring and sear while using the sear pin to push the punch out of the frame.

Place the hammer strut in the frame, kinked end towards the muzzle. Place the hammer in the frame, and push the hammer pin in from the right. Push the hammer forward to the un-cocked position. Slide the mainspring into place, and make sure you have the top end of the hammer strut in its seat in the hammer. Grasp the frame, and pressing against the bench, push the lanyard loop into the frame and slide its retaining pin into the frame.

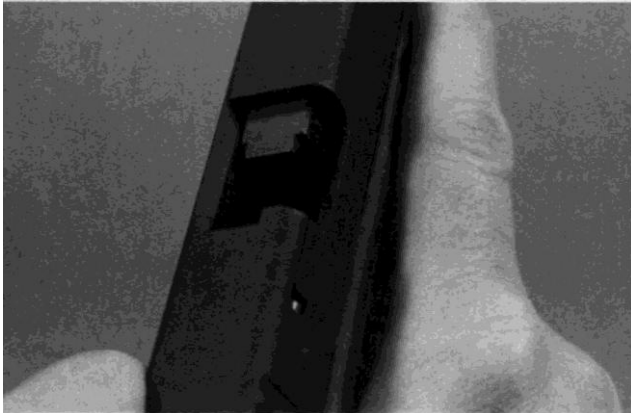
Cleaning the Glock

The Glock is different, and in some major ways. Make sure the gun is not loaded, and, to begin the disassembly, dry-fire it. Hold the slide back 1/10-inch to take the recoil spring tension off of the disassembly lever, and pull this lever down on both sides of the frame at the same time. If you pull the slide back too far you will re-set the mechanism and must dry fire the pistol again and start over. With the disassembly lever down, the slide assembly slides off of the frame.

Older Glockes have their recoil spring and guide rod separated, and you have to be careful prying the rear of the guide rod out of its seat in the barrel. If you lose your grip, you'll launch the rod and probably lose track of the spring, too. Newer Glockes have the recoil spring and guide rod assembled as a unit at the factory, and they stay together. No more springs and rods across the room.

Before you scrub the barrel and slide, you must know two important details. If your Glock is brand-new it will have copper gunk on the underside. This gunk, an anti-seize compound, is placed there by the factory so the slide and disconnecter can properly burnish against each other. Though it will gradually wear away, you should not clean it away. (This is one way to tell if a Glock really is “brand new.” If it doesn’t have this compound, it isn’t new, no matter how clean it looks.)

You only need a single drift punch to disassemble the Glock for cleaning and service.



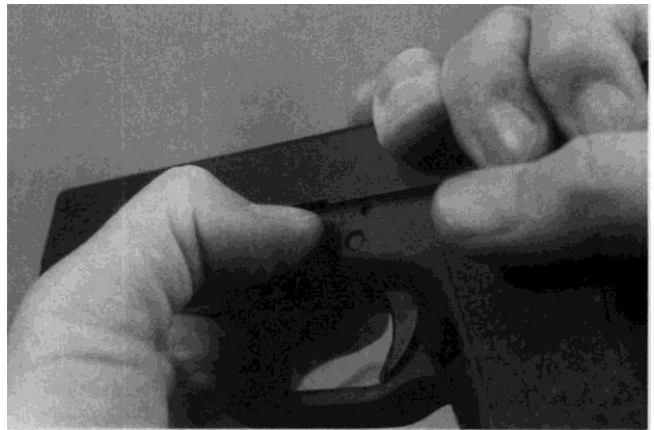
(1) Make sure the Glock is unloaded.



(2) Dry fire the pistol. Grab the slide, and ease the slide back less than half an inch.



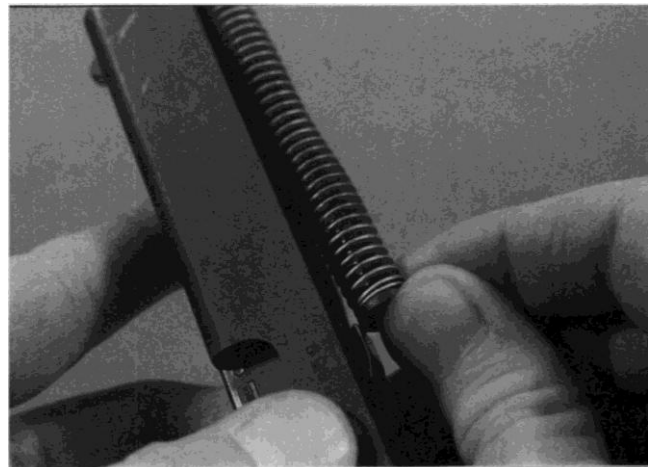
(3) If you pull the slide back any more than this you will reset the striker, and have to dry-fire to start over again.



(4) Pull down the disassembly levers on both sides.



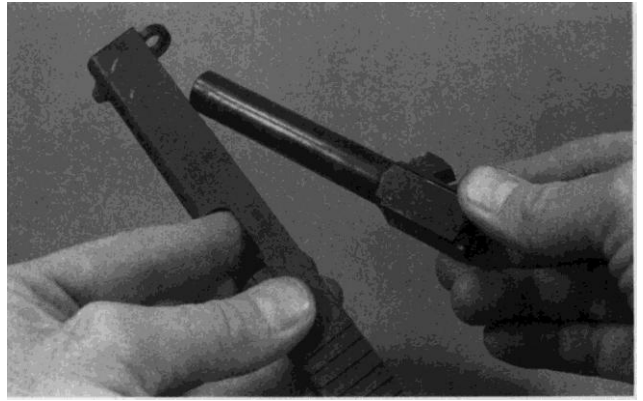
(5) And let the slide go forward.



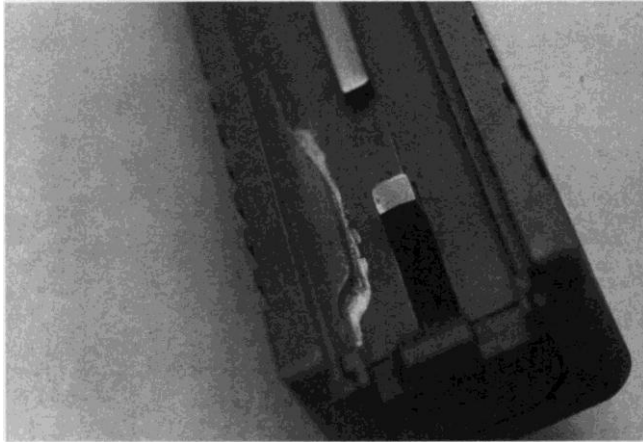
(6) Catch the rear of the recoil spring assembly and lift it out of its seat in the barrel.



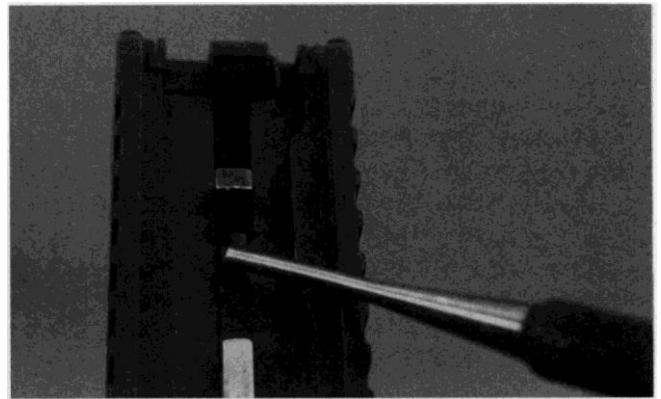
(1) Push the rear of the barrel out of the slide.



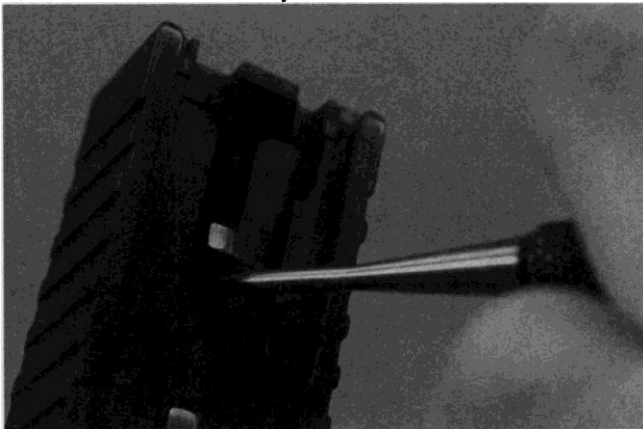
(2) And lift the barrel free, pulling it to the rear out of the slide.



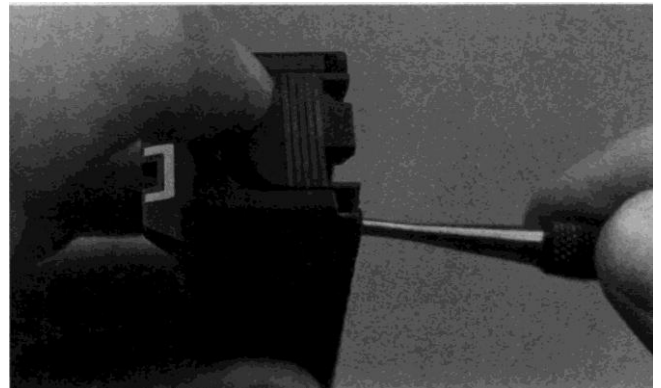
(3) Glock puts anti-seize compound on their slides at the factory. This allows the disconnecter to function properly until the parts are broken-in. Do not remove it. If your pistol does not have this, it is not new, no matter how clean it may be.



(4) There is a small amount of the striker cup shoulder visible in the striker slot. You will press this shoulder towards the muzzle to disassemble the slide.



(5) Use the drift punch to press the striker shoulder forward.

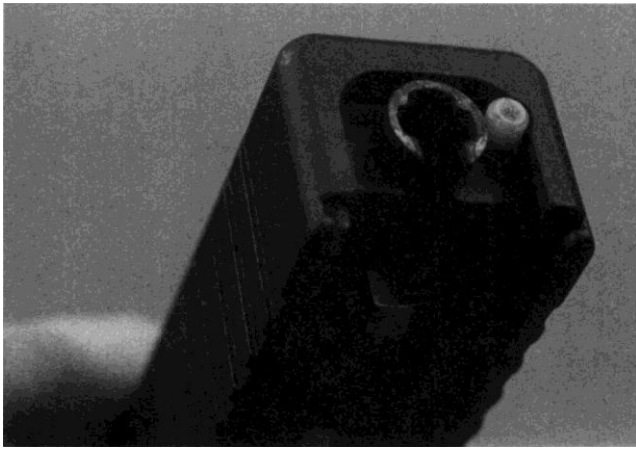


(6) While holding the striker shoulder down, slip the retaining plate off the slide.

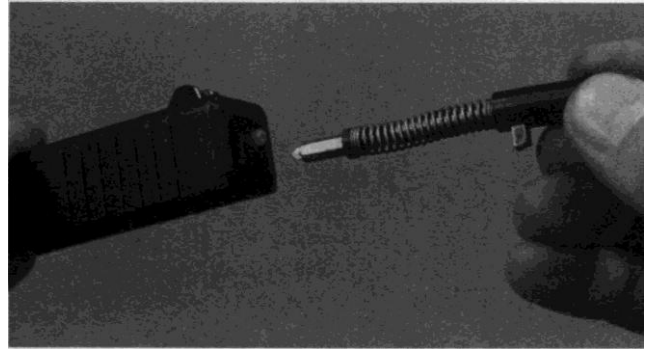
The second detail? The Glock striker (firing pin) and its tunnel should not be oiled. Not at all. To reduce friction the striker tunnel is lined with a plastic sleeve. The striker spring is assembled to the striker with two little plastic cups. If you oil the tunnel, the oil will attract grit, dust and powder residue, which will act as a lapping compound to grind up the plastic.

For a simple cleaning of your Glock proceed as in the 1911.

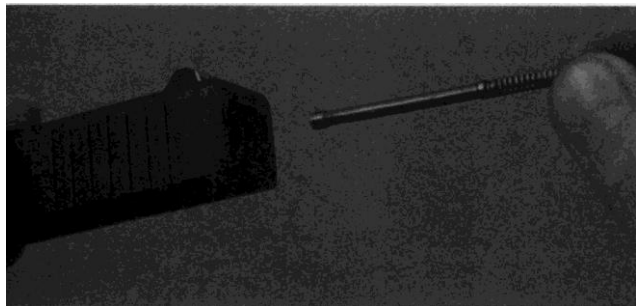
A detail cleaning of the Glock first requires stripping the slide. Look at the front end of the striker slot, under the slide. Find the edge of the plastic cup. With a punch, press and hold it towards the muzzle. With the cup held in place, work a small screwdriver into the gap between the back of the slide and the striker retainer plate. Pry the plate down part way. Let go of the punch holding the striker cup. Remove the striker retainer plate, using your fingers to keep the extractor plunger from launching itself out of the slide. With the plate off, pull the striker assembly and the extractor plunger assembly out. Depress the firing pin safety and lift the extractor out of its slot. Remove the firing pin safety.



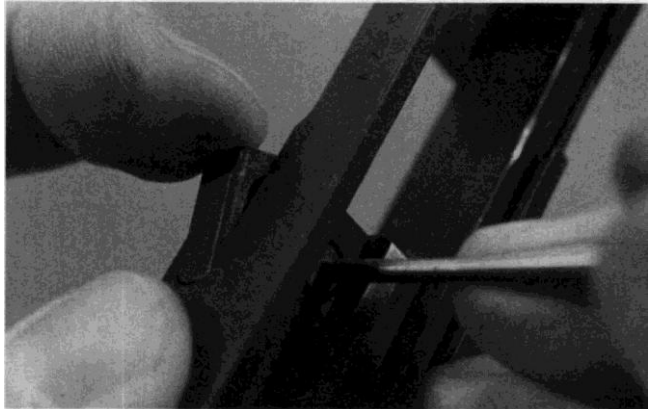
(1) With the retaining plate off, you can see the rear of the striker and extractor assemblies



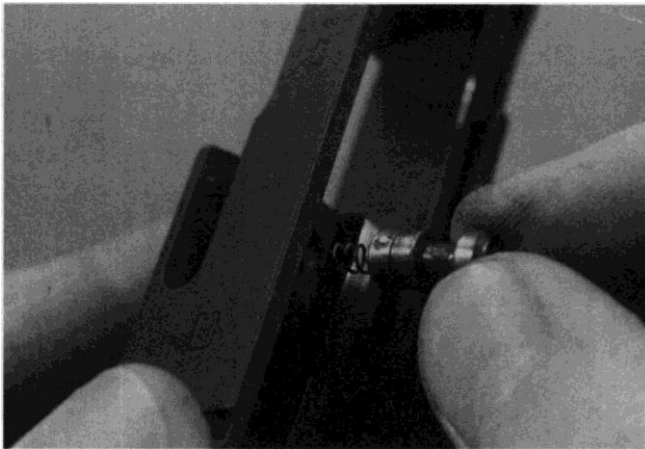
(2) Pull the striker assembly free. Never oil the striker or its tunnel. The oil will attract dirt.



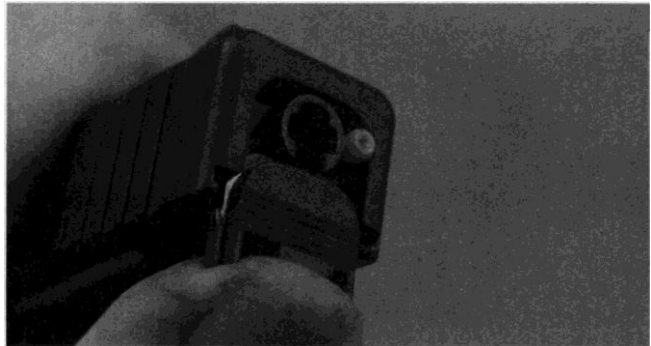
(3) The Glock ejector spring and plunger now lift out of the slide.



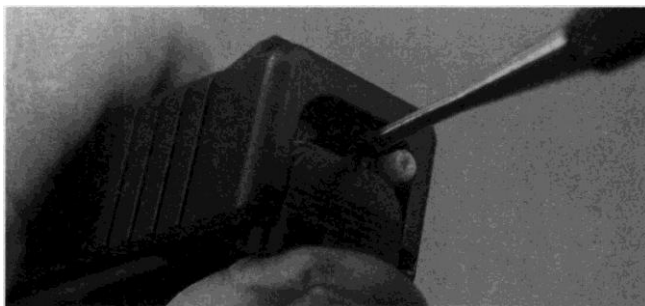
(4) Depress the striker safety and carefully pivot the extractor out of the slide.



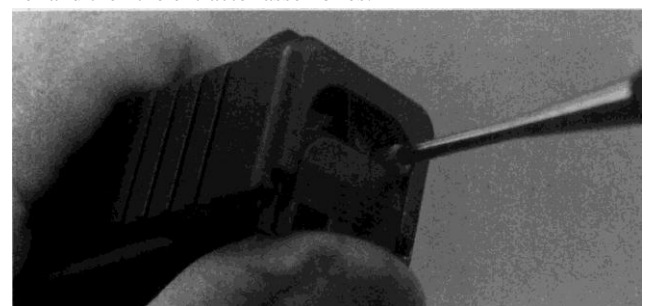
(5) With the extractor out, pull the striker safety free.



(6) To push the retaining plate back into place you must depress first the striker and then the extractor assemblies.



(7) Press the back of the striker assembly into the slide.

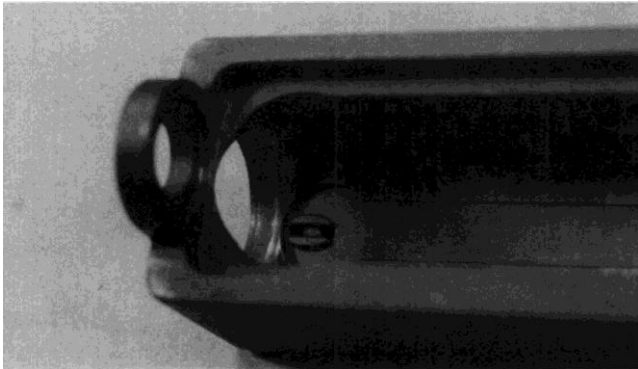


(8) Push the extractor plunger down and press the retaining plate completely up into the slide.

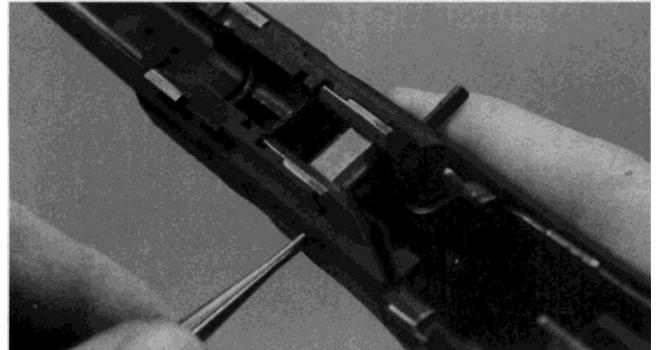
Scrub everything clean. Check the extractor for chips or breaks. If your extractor is chipped but still works, keep using it, but write the Glock Factory Service Department to get a new one. Place a drop of oil on the firing pin safety spring and the foot of the extractor. To reassemble the slide, push the firing pin safety into its hole, and hold it down while you insert the extractor in the slide. The extractor plunger, spring and cap, and striker assembly go in next. The edges of the striker retainer get a drop of oil before you start sliding the striker retainer in place. Depress the extractor cap to clear the retainer. Once the cap is down, push the striker spacer cup down, and slide the retainer plate all the way in. Before replacing the barrel in the slide, oil the top inside surface of the slide.

Now disassemble the frame. Original Glock 17's only had one pin holding the locking block in place. With the start of Glock 22 production, the locking block gained another pin called the locking pin. This pin, if present, should always be the first pin out on disassembly, and the first pin in on reassembly. Push it out from left to right. The trigger pin, common to all Glocks, and held into the frame by the slide stop lever, requires a bit of fussing. Press on the pin. At the same time, wiggle the slide stop lever until the pin shoulder clears the edge of the hole through the lever. Remove the pin.

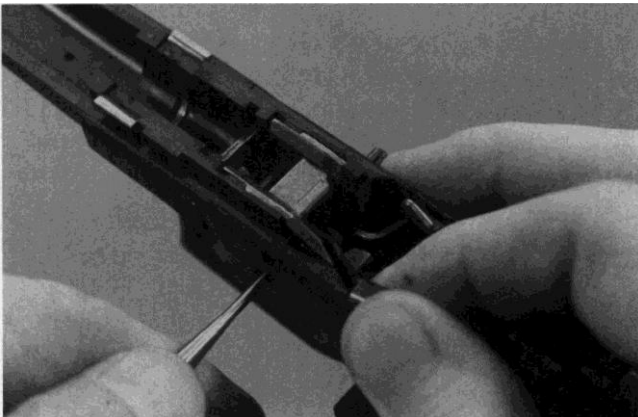
Lift the slide stop lever out of the frame. Stick a small screwdriver or drift pin under the locking block and pry the block out of the frame. It will lift up along guide slots cast into the frame.



(1) The Glock front sight is plastic, and held in place with a tiny wedge.



(2) Push the upper locking block pin out of the frame.



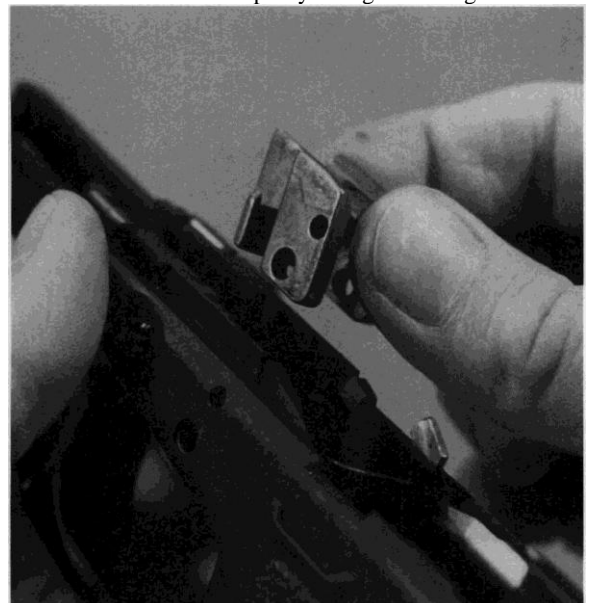
(3) Grasp the slide stop and lift it against its spring, so you can push the locking block pin clear.



(4) With the disassembly notch lined up to the slide stop, push the slide stop out of the frame with the tip of your right forefinger.



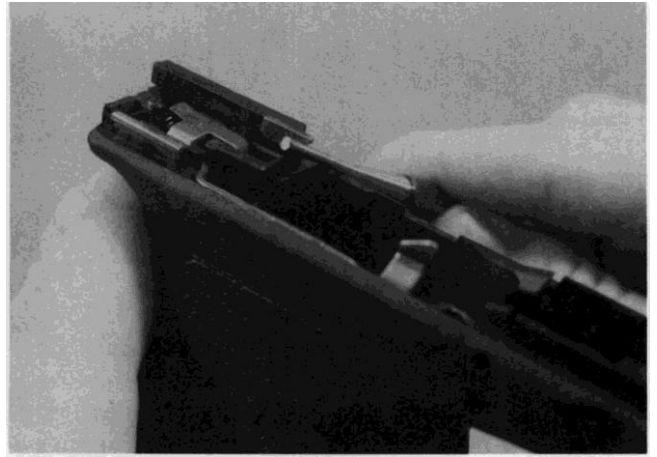
(5) Use your drift punch to pry the locking block free from the frame.



(6) Pull the locking block up out of the frame.



(7) Press the rear retaining pin out.



(8) With all the frame pins out, hook the punch under the ejector and use the left side of the frame as your pivot point.



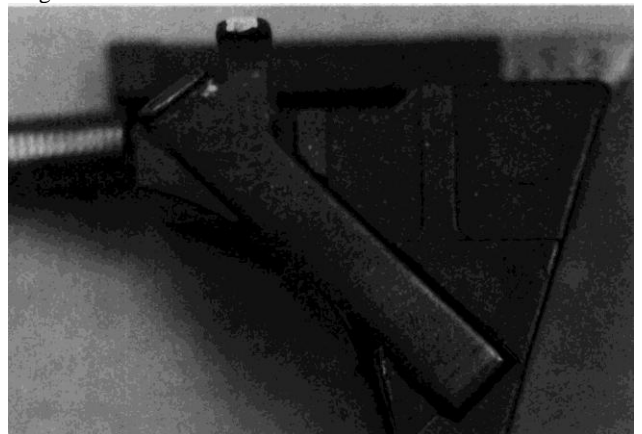
(9) The Glock trigger bar as it rests in the housing.



(10) To remove the trigger bar, rotate the bar out from under the trigger housing shoulder.



(11) The Glock trigger bar and its return spring.



(12) This is the Glock connector. The angle of the shoulder at the end of the arm determines the trigger pull of the pistol.

Turn to the back of the frame and push the trigger mechanism housing pin out. Since it is not locked in it should slide out easily. Remove the trigger assembly by sticking your same small screwdriver or drift pin under the ejector. Use the ejector to pry the trigger assembly out. Carefully lift the entire assembly out of the frame without further disassembly.

Look closely at how the trigger bar and trigger housing fit together. With the housing in your left hand, and the trigger in your right hand, give the trigger and trigger bar a turn counterclockwise, and pull them up out of the housing. The spring should stay attached. Before you clean these up, practice putting the end of the trigger bar back into the housing. Twist it clockwise to reassemble it. Do this a few times until you have a good feel for how the parts fit. It's ingenious, and not obvious if you don't closely observe and practice it.

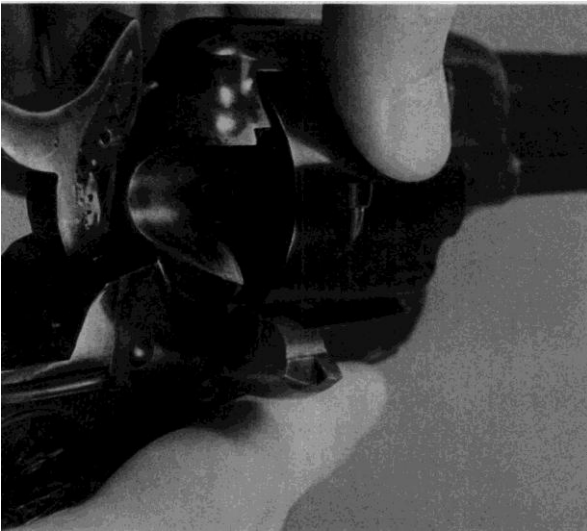
Scrub these parts clean, except for the anti-seize compound on the connector. Remember, leave that alone.

Begin reassembly by inserting the trigger assembly into the frame. Push the rear pin in place. Push the locking block into the frame. Insert the locking block pin through the frame and block. Insert the slide stop lever, and start the lower (trigger) pin. Wiggle the slide stop until the trigger pin slides through its hole in the slide stop.

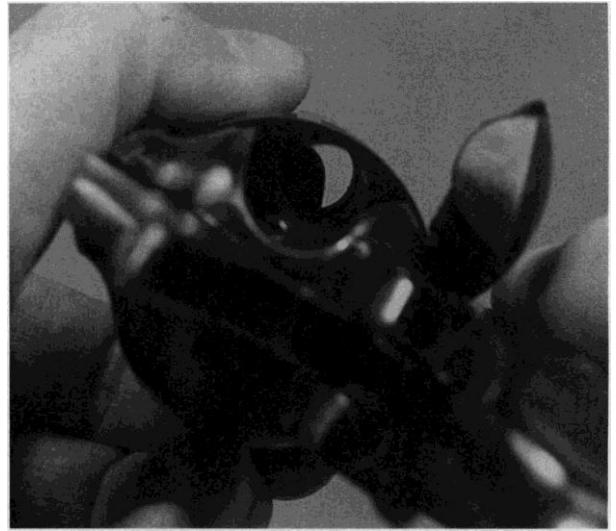
Before putting the slide assembly back, oil the top front corner of the locking block. Slide the assembly on. You do not have to hold down the disassembly levers. Just run the slide back far enough to re-set the mechanism. The disassembly lever locks in place.

Cleaning the Single-Action Revolver

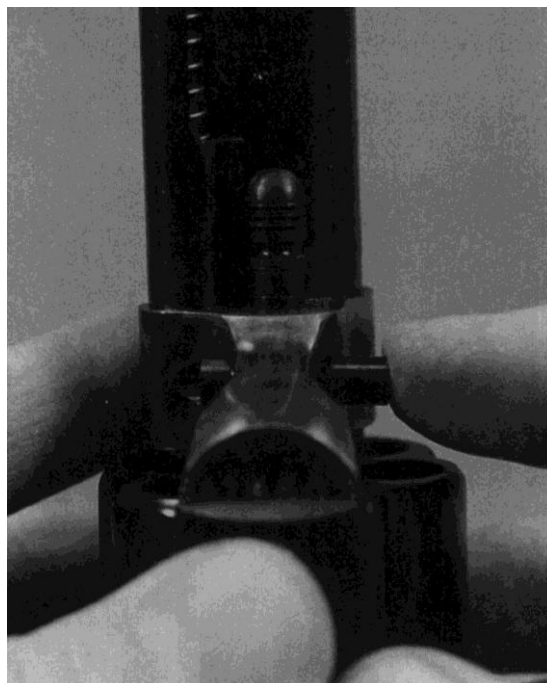
A simple cleaning of the single-action revolver is easy. I have described the Colt and Old Model Ruger simple cleaning together, as they are identical. The detailed cleaning of Colt, Old Model Ruger and New Model Ruger have their own niceties, so I have separated them. The demonstration revolver is an EMF Dakota.



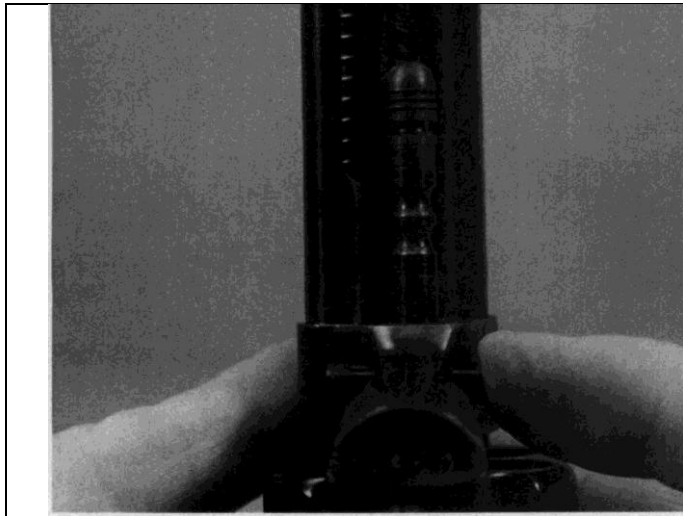
Thumb the hammer back to the second notch, open the loading gate and rotate the cylinder.



Make sure the revolver is unloaded.



The retaining catch is spring-loaded.



Push the retaining catch to the side and pull the center pin out of the cylinder and frame.

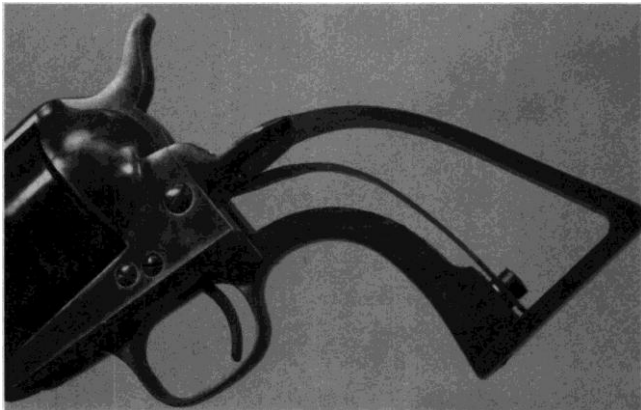


Remove the cylinder.

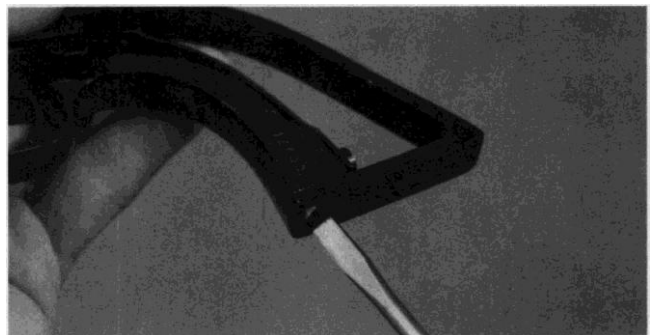
Colt, Colt clones and Old Ruger simple cleaning

First, check that your Colt or Ruger is not loaded. Draw the hammer back to the second click, which lowers the locking bolt and allows the cylinder to be rotated. Open the loading gate. Press the spring-loaded plunger (located in the front of the frame) crossways, and pull the centerpin out of the frame. Lift the cylinder out of the frame through the loading gate opening. Scrub the powder residue, and brush each of the chambers just as much as you do the barrel. Get everything clean.

For reassembly, make sure the hammer is still at the second click. Place the cylinder into the frame. You may want to put a drop of oil on the centerpin. Hold the cylinder in place as you juggle the revolver to reseal the plunger and insert the centerpin, sliding it in from the front.



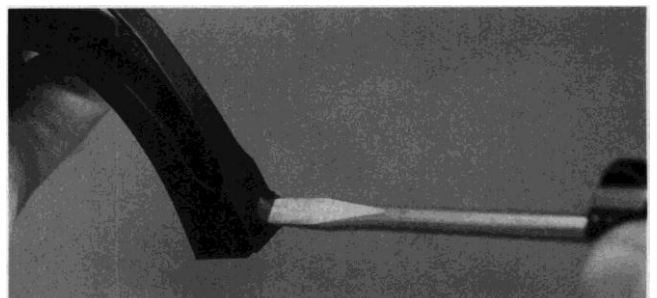
(1) The grip straps of the Colt or its clones are two pieces. To take these off the revolver requires removing seven or eight screws. Some grips do not use a screw to hold them on the revolver, thus the difference.



(2) The upper half of the grip straps are kept in place by three screws, one at the bottom of the frame



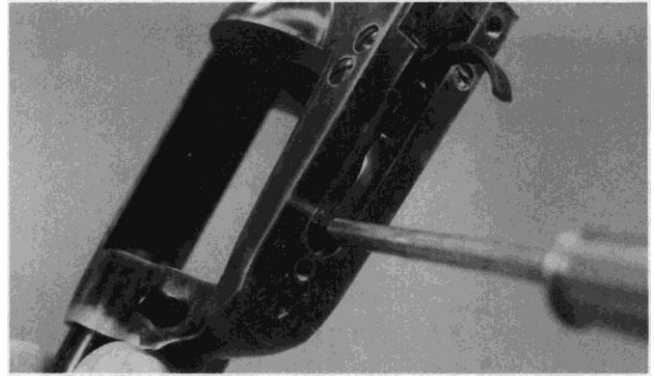
(3) and two at the top on either side of the hammer.



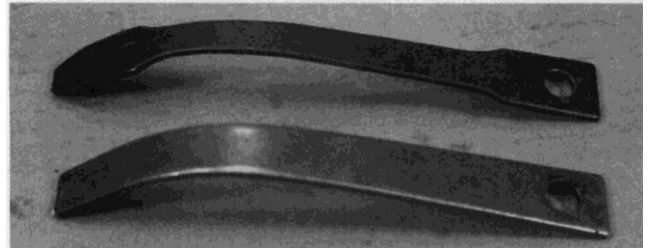
(4) The mainspring screw must be removed before you can remove the lower half of the grip straps.



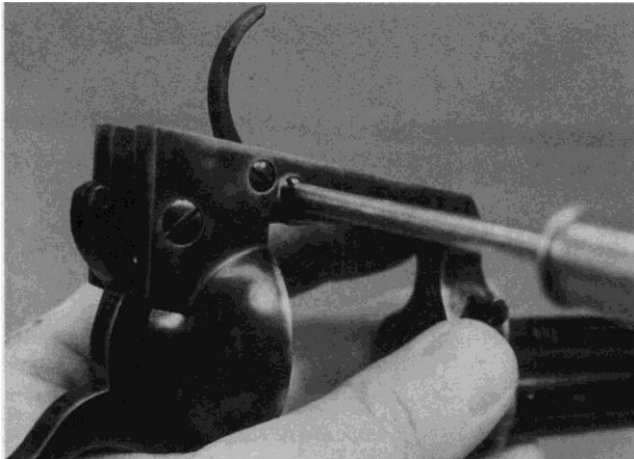
(5) Remove the three screws from the bottom half of the grip straps.



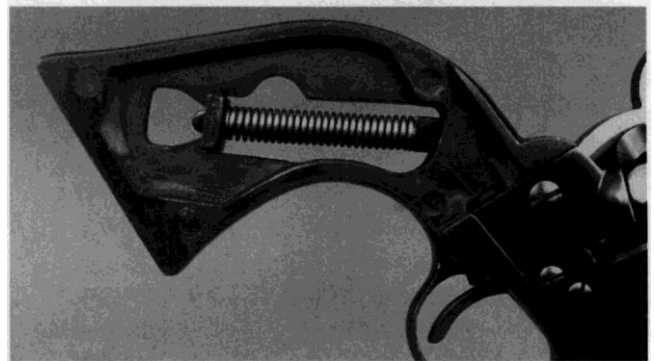
(6) The Colt single-action has a trigger-locking bolt spring with two leaves. Remove the screw and inspect the spring.



The EMF reduced-power mainspring on the top. Simply switching from your full-power mainspring to this one will ease the work of cocking your single-action Colt or clone.



(7) Remove the trigger, locking bolt and hammer screws.



The Ruger mainspring is a coil spring, riding on a shaft.

Colt and EMF single-action detail cleaning

The detailed cleaning of the Colt single-action revolver involves as many as a dozen screws. Check your screwdrivers to make sure they are a proper fit or you will chew up a lot of screw slots. Begin by removing the backstrap. Remove the screw in the butt of the frame, and the two screws below the hammer. When you set the backstrap aside, put the screws back through their holes. By doing this, you will not only keep the screws where they belong in the frame, you'll also avoid misplacing them. The large flat spring you see is the mainspring. Unscrew the mainspring retention screw.

On the bottom of the trigger housing are three screws. Remove these. On the Colt, the locking bolt and spring are worked by the flat, two-leaf spring in the bottom of the frame. Remove the screw holding this spring in, and while you have the spring in hand give it a thorough inspection. The fingers are prone to cracking and breaking off. If you see even a small crack replace the spring.

Now find the three screws on the side of the frame. Unscrew the two smaller ones, and after you pull them out remove the trigger and locking bolt. Unscrew the bigger one, and draw the hammer down out of its slot, guided by the hand riding in its slot.

Scrub everything, and reassemble in the reverse order. Note: You should tighten the three screws holding the trigger guard in place before you tighten the mainspring screw. Otherwise, you will be holding the trigger guard in place against the tension of the mainspring. It is strong. You will lose.

Old Model Ruger detail cleaning

Remove the grips on the Ruger. The Ruger mainspring is a coil spring over a strut. Cock the Ruger and put a pin through the hole in the bottom of the strut. Lower the hammer. The Ruger grip frame is a single piece. You will remove the mainspring assembly when you pull the grip frame loose.

Loosen the two screws below the hammer, and the three screws around the trigger guard. On the Colt the two screws under the hammer are identical. On the Ruger the left-hand screw holds in the hand spring, so keep this one in the left side of the backstrap when you set it down. Pull the hand spring and plunger out of the hole, and set them aside.

The trigger return spring is hooked and pivoted behind the trigger. Unhook the legs from their posts. The trigger housing contains the locking bolt spring and plunger. These are small parts. Be careful!

You can now pull the entire grip frame away from the main frame. Scrub everything clean.

Clamp the frame upside down in a padded vise for reassembly of the lower frame to the upper. To make reassembly a little less difficult, place a drop of oil on all moving parts before beginning. Place the mainspring strut assembly in the housing. The top of the strut rides in a slot cut into the back of the hammer. Align the top with the slot. You will have to juggle the grip frame onto the cylinder frame, and keep the locking bolt spring and plunger in place, while aligning the strut and slot (see above), and the trigger return spring and hand spring (see below). Hook the trigger return spring over its shelf on the trigger. Check to make sure the mainspring strut assembly is still in its bearing slot. Be careful not to crush the hand spring when sliding the grip frame in place. There are a lot of little things to watch for in this procedure. I wonder where the Ruger factory finds six-fingered people to hire as assemblers.

With your thumb, hold the grip frame down. Check to see that the mainspring assembly is still properly aligned. If it isn't, realign it. You can't do this after the grip frame is secured. Start the three bottom (trigger guard) screws. You need to snug one of these down before you can let go of the grip frame. Tighten all three screws. Tighten the two screws below the hammer.

Cock the hammer and remove the capture pin. To check the function of the hammer and trigger, thumb the hammer back. Watch the locking bolt to see that it drops down into the frame and pops back up.

If everything appears to work, put the cylinder in and check function again. Wipe down the exterior and put the revolver away.

New Model Ruger Detail Cleaning

The re-design of the Ruger single-action revolver that culminated in the New Model changed the revolver's safety features, and some aspects of the disassembly. The New Model has no screws for the hammer, trigger and locking bolt, which are held in by crosspins. Because the loading gate now unlocks the cylinder for rotation, you no longer have to partially cock the hammer to load, unload or disassemble the revolver.

For a simple cleaning, open the loading gate and make sure the revolver is unloaded. Press the centerpin plunger. Draw the centerpin out of the frame. The cylinder now drops free of the frame. Wipe off the powder residue and scrub the bore and chambers clean.

For detailed cleaning, follow the Old Model disassembly up to the removal of the trigger, locking bolt and hammer.

Once you have removed the lower frame, turn the revolver upside down and clamp it in a padded vise. The spring that activates the locking bolt also works the loading gate and keeps the trigger pin from falling out. Use a drift pin to push down the leg of this spring where it passes through the slot in the trigger pin. With the spring held down out of the way (and it is a strong one!) push the trigger pin out of the frame. Lift the spring, trigger and locking bolt out of the frame. Push the hammer pin out of the frame. Lift the hammer and hand out of the frame.

Scrub everything.

To reassemble, put the hammer in place. Push the hammer pin into the frame. Place the locking bolt, loading gate and trigger in the frame, and start inserting the trigger pin. Begin from the side opposite the spring. Slide the pin up to the spring. Push the spring down to clear the pin. Slide the pin the rest of the way over. Release the spring. Check the locking bolt, loading gate and trigger to see that the spring is bearing on them properly. If the tip of the spring does not correctly engage the loading gate, the gate will not work. If you do not discover this until you do your final reassembly check, you will have to remove all the parts to get back to the spring. Save time, and check now.

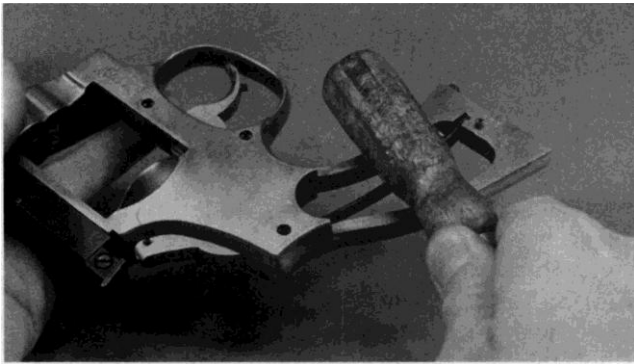
With the spring in place, reassembly follows the Old Model pattern.

Cleaning the Double-Action Revolver

Double-action revolvers fall into two camps, revolvers with sideplates, and Rugers.

On the Smith & Wesson, Colt, Taurus, Rossi and any revolvers that have sideplates, remove the front screw and the cylinders for a simple cleaning. With the cylinder removed, scrub the bore and chambers, and wipe the powder residue off of the frame. Replace the cylinder. On the Ruger DA revolvers leave the cylinder in place. Wipe, scrub, and you're done.

In a detailed cleaning of revolvers with a sideplate, remove the screws. Carefully set them aside in the order they came off the frame. Handling screws carefully is especially important in older S&W, Taurus and Rossi revolvers. Front sideplate screws on these models are precisely fitted to hold the crane without binding. If you inadvertently switch screws you can cause the crane to bind on opening and closing. On new S&Ws and Colts the crane retention screw is a spring-loaded plunger assembly, and is too large to mix up with the sideplate screws.



Once the sideplate screws are out, rap the frame with a wooden bar, hammer handle or large screwdriver handle to loosen the sideplate. Do not pry the sideplate out, you may bend or mar it.



With the sideplate loose you can begin removing the internal parts.

Hold the frame in your left hand, with your thumb over but not touching the sideplate. With a hammer handle or a wooden block in your right hand whack the grip straps. You want to pop the sideplate out with inertia. Aim for your bench, and do not let the sideplate hit the floor. Do not pry the sideplate to remove it. Prying will burr the edge and run the risk of bending it. A bent sideplate can interfere with proper function.

There are two ways to remove the mainspring on S&W, Taurus and Rossi revolvers. If it is a flat spring, back out the strain screw at the bottom of the front grip strap. Pull the bottom of the spring out of its slot in the frame, and unhook the top from the hammer stirrup. If it is a coil spring, cock the revolver and put a capture pin through the hole at the bottom of the strut. Release the hammer. The capture pin will keep the spring compressed, allowing you to remove the strut and spring together. Lift out the safety bar.

With a tapered screwdriver, pry up the back end of the trigger rebound bar. Don't let the spring launch itself out. With the rebound bar out, cock the hammer before lifting it from the frame. Pull the hand back from its slot, and lift the trigger and hand out of the frame together.

On Colts, we again have two methods to remove the mainspring. On the Python, Detective Special, and other Colt revolvers with a "V" spring, clamp the spring with a pair of needle-nose pliers and work it out from under the hammer stirrup. Lift the hand out of the trigger. Drift out the action bar pin and remove the action bar. Cock the hammer and lift it out. Look at the trigger assembly; make sure you understand how its parts fit. Now lift it out.

Newer Colts have a coil mainspring. Cock the hammer. Put a capture pin through the strut, as per the S&W and Taurus. The newer Colt revolver internals lift out without having to lever against any springs.

Remove the locking bolt. On the S&W, Taurus, and Rossi revolvers, a spring pushes the locking bolt up. Use a small drift pin or dental pick to push the locking bolt down against the spring. Wedge another dental pick under the bolt. Slide the bolt up its shaft. Be patient. There isn't a lot of room here. On the Colt "V" spring models a small screw holds the locking bolt in. Unless you are replacing the bolt, do not remove the screw. Check it for tightness, and then leave it alone.

Scrub all the parts and the frame.

Last parts out, first parts in. On the S&W, Taurus and Rossi revolvers place the locking bolt on its shaft. Insert the spring in the bolt. Slide the bolt down the shaft until the spring binds against the frame. Use a small screwdriver to compress the spring into the bolt, and shove the bolt and its spring the rest of the way down into the frame.

Take the trigger and hand, and tilting the hand back, slide the trigger down onto its shaft. Once it is down, tilt the hand forward into its slot. Hold the frame in your left hand. Use your left index finger to pull the cylinder release back. Continue holding it down. Pull the trigger with your left middle finger, and hold it back. Put the hammer on the hammer shaft, in its full-cock position, and push it down into the frame. Release the trigger and push it and the hammer to their forward, resting position. Start fitting the front of the rebound block into the back of the trigger. Compress the rebound slide spring until you can push it down behind the rebound bar retaining stud. Place the safety bar onto its pin on the rebound block.

On the Colt "V" spring revolvers, reassembly starts with the trigger linkage. Hook the long end of the flat bar onto the trigger, positioning ring down. Hook the safety bar onto the short end of the flat bar. Come from underneath the flat bar. The whole assembly must fit over the hammer shaft boss and trigger pivot pin as one piece. Put the hammer on its shaft. Place the action bar into the frame and drift its pin through. Put the hand onto the trigger. Make sure it is down all the way. The action bar point must cam against the hand's internal shoulder. With your needle-nose pliers compress the "V" spring and hook it under the hammer stirrup.

On all the revolvers, place a drop of oil on all the internal parts, either where they rotate or where they engage other parts. On the hammer, oil the pivot hole, the pivot of the DA sear, the mainspring stirrup, and the SA notch. On the trigger, oil the pivot hole, the hand spring and slot, and the bolt tip. On the cylinder bolt, oil the spring and the pivot hole. On the rebound block, oil all four sides, as well as the trigger return spring.

In the cylinder, place a drop of oil on the center pin at both ends. Lift the extractor star and place a drop of oil at its base. Let the extractor slide back in place.

On the crane, place a drop of oil on the outside. Rub the oil around with your fingers. Place a drop of oil inside the crane, place the cylinder into it, and give the cylinder a spin.

Secure the sideplate. Wipe down the exterior first with an oily rag, then with a dry one. You should be able to see an oily finish, but not feel it when touching the surface. Too much oil will attract lint and dust.

Detail Cleaning of Ruger Double-Action Revolvers

At first glance, the Ruger double-action revolver seems strange. There is no sideplate, and the only screw to be seen is in the grips. How to disassemble it?

Take the grips off. You'll find a pin in a recess inside the grip. This is the mainspring capture pin. Cock the hammer, put the pin through the hole at the bottom of the strut, and release the hammer. Pull the base of the strut to one side, and pull the mainspring assembly down out of the frame.

Look at the hammer pin. One side the pin has a flat tail. Push from the other side to remove the pin. Lift the hammer out of the receiver.

The plunger which holds the trigger assembly in the receiver is located at the top of the grip frame cutout. Use a drift pin to push the plunger towards the trigger. When the plunger clears the frame the rear of the trigger assembly will move down from the frame. The trigger guard assembly is hooked into the frame at the assembly's front. Grasp the trigger guard. Pivot the rear of the assembly down as you pivot it free of the frame.

Open the cylinder and pull it forward out of the frame.

Before disassembling the trigger assembly any further, look at it carefully. The parts, pushed by small springs and plungers, pivot in their seats in the trigger guard body. If, for example, you snatch the safety bar out, you will launch its spring and plunger. Work each part out carefully and set it aside with its respective spring and plunger. If you think you'll clean the entire assembly without handling the small parts, think again. Simply aerosol-blasting the assembly, or scrubbing it as one piece and finishing with compressed air will scatter all the little parts all across the room. Be patient. It works better in the long run.

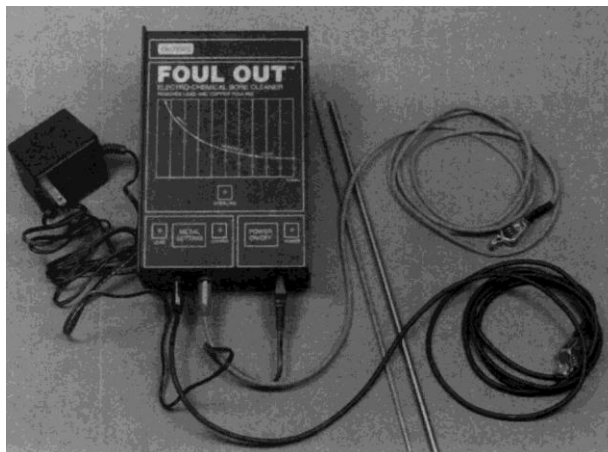
As with the Ruger New Model single-action revolvers, oil all the clean parts before assembly.

Replace the cylinder and close it in the frame.

Hook the front of the trigger guard assembly into the frame. Pivot the rear up. If you feel some resistance, stop and look down through the hammer slot. Find the top of the safety bar. It may be binding against the cylinder release. Reduce the pressure on the trigger guard and, with a small screwdriver, pivot the safety bar back from the cylinder release. Continue pressing on the trigger guard until the plunger at the rear snaps in place in the frame.

Insert the hammer into the frame from the top. Line the hammer pivot hole up with the hole through the frame. Push the hammer pivot pin into the frame, making sure the hammer pivot pin tail is in the slot cast for it on the side of the frame.

Work the mainspring strut up into the frame. Put the base on the frame seat and cock the hammer. Remove the capture pin. Be sure to put the pin into its storage slot in the grips! Finally, reinstall the grips.

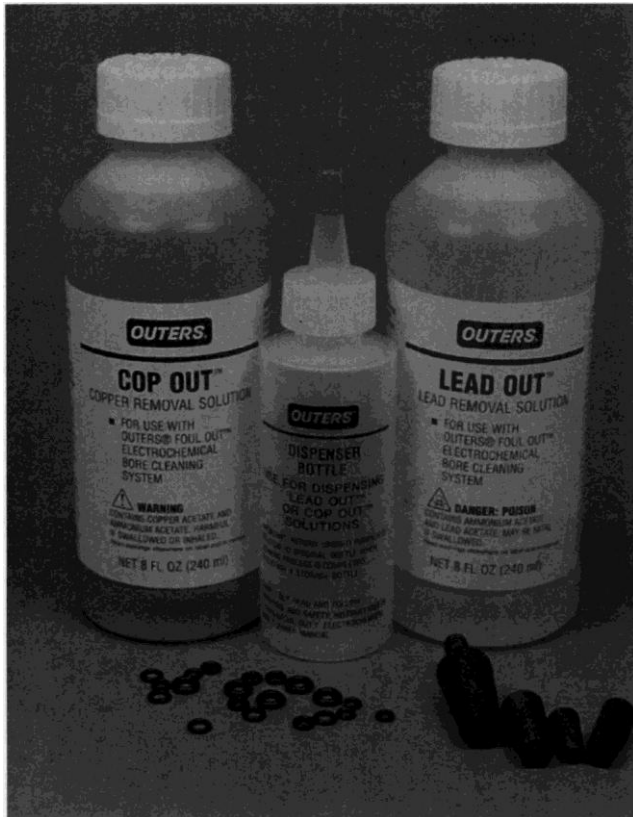


The Outers Foul-Out makes bore cleaning such a snap, you won't believe it.

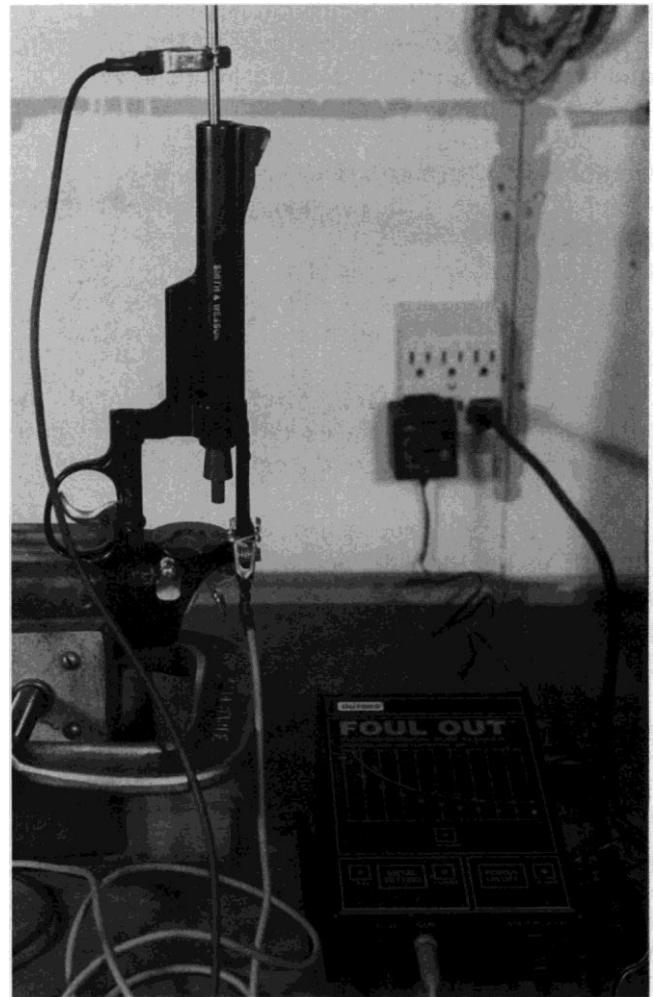
The Outers Foul Out™

A heavily lead- or copper-fouled bore can require a great deal of elbow grease to clean, and take a lot of time in the process. An easier way is to use the Outers Foul-Out.™

It removes the lead and copper by reverse electroplating. With a chemical solution and a sacrificial rod in the bore, and electricity, you plate the lead or copper off the bore and onto the rod.



The Foul-Out comes with separate solutions for lead and copper. Also included are bore plugs and O-rings to keep the rod from touching your barrel. If the rod touches the barrel the unit will not work.



Here is the Outers Foul-Out cleaning up a Smith & Wesson .44 Magnum. After an hour, there is no more lead or copper in the bore. Quick, painless and difficult to do wrong, this is a neat tool.

There are some catches. You can't use the same solution for both lead and copper. If you have a bore with lead and you use the copper solution, you don't get any result. The same is true with copper fouling and lead solution. If you have a bore with both, you have to use both, one after the other.

There's a second catch. If you do not follow the instruction exactly, you can begin eating up your barrel.

Read the instructions that come with the unit. The booklet may seem thin, but it has lots of information, information you need to know. What doesn't come with the unit is a method of holding your barrel. You need to hold the barrel firmly and vertically. Simply standing it in a corner will not do. I went to the local hardware warehouse and found a small stand and an insulated clamp.

The important things to keep in mind, after you have read the instructions, are these;

You must de-grease thoroughly. The barrel and the rod must be clean of lubricants, or the solution may not reach the surface of the fouling.

The O-rings are there to prevent the rod from touching the barrel. If you select a ring that is too large, the unit cannot clean the bore at the point the O-ring is pressing against it.

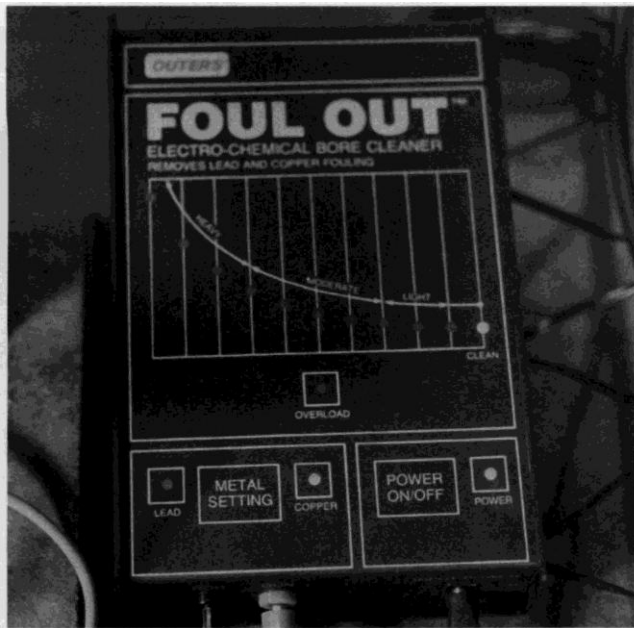
Scrub the rod between cleaning cycles with dry abrasive cloth. Do not use steel wool. It has oil as an anti-rusting agent. The oil will prevent proper cleaning.

The first time you clean a barrel, check for corrosion. After the first 15 to 30 minutes, stop the unit and pour the solution out. If the solution has become yellowed, corrosion is present. If you continue using the Foul-Out™ you will attack the steel of the barrel itself. Pour out the solution and use patches and brush on the bore. Brush vigorously and use patches until they come out clean. Degrease the bore and start over again with fresh solution. Repeat until the Foul-Out™ solution does not yellow. Then you can begin removing the fouling.

As with all cleaning solutions, the solvents used in Foul-Out™ can be hazardous to your health. Wash thoroughly if you spill any on yourself. Of course you will not be doing this in the kitchen, nor will you be eating lunch while cleaning your handguns, right?

The Outers Foul-Out™ is the greatest thing since sliced bread (what was the comparison before sliced bread?) and will ease your cleaning chores. A clean bore in your handgun means greater accuracy, a longer service life and less chance of a gunked-up bore causing a malfunction.

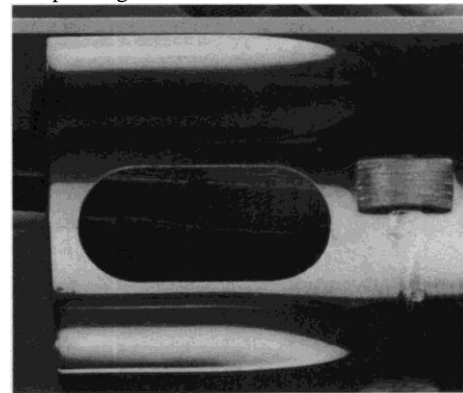
How much do I like the Foul-Out™? When I was done with the testing, Outers did not get the unit back. It resides in a corner of my shop, waiting patiently each day for the handguns that return from the range.



The Outers Foul-Out lets you know when you are done. When only the "clean" light is lit, there is no more of that metal left in the bore.



A cylinder leaded-up, or with crusty chambers from using short brass, requires aggressive cleaning. This chamber cleaning reamer from Clymer will scrape the gunk out.



The reamer removes the lead, but does not cut the steel of the chamber.

Specialized cleaning tools

Some cleaning jobs on your handguns will require specialized tools. Without them you will spend more time cleaning-time you could have devoted to reloading ammunition, or to your family. Specialized cleaning tools you may need are: chamber reamer, collared chamber brush, slide hoe, and a range rod.

Some revolver calibers are designed to allow shorter caliber rounds to be fired in them. You can fire .38 Specials in a .357 Magnum, .44 Russian or .44 Specials in a .44 Magnum, and .45 Schofields in a .45 Colt. In all these situations, the lesser-powered case is simply a shorter version of the Magnum or larger round.

You cannot use a .38 Smith & Wesson in the .38 Special, nor can you use 9mm Kurtz in the 9mm Parabellum. These are not simply short versions of the longer cartridge, but a different cartridge entirely.

The problem with using a short cartridge in a long chamber is the powder build-up. At the front of the chamber there is a shoulder stepping from the case diameter to the bullet diameter. The shoulder guides the bullet into the forcing cone. If you use a shorter case, you end up with a gap between the end of the case and the start of the shoulder. This gap gets caked with powder residue. When you load a longer case into the crudded-up chamber, it may slip into place just fine. On firing, however, the case expands against the crud and locks the empty in place. Extracting locked-in empties is no fun.

If you are in the habit of shooting short cases, get a reamer. Clymer makes one that scrapes most of the crud out. You can brush out the rest. Brushing alone takes a good, long while.

Powder residue builds up differently in pistol chambers. Because the empty cases are yanked out after each shot, powder residue is shaken out of the case and left in the chamber. Each successive round pushes some of this residue forward against the front edge of the chamber. The rest stays in the chamber and gets hammered flat by the expanding case. Each just-fired case takes some of the powder residue it has hammered flat out of the pistol, and deposits still more.

Eventually you end up with flat sheets of powder residue packed hard against the sides of your chamber. The powder residue pushed forward creates a crusted ring at the chamber front. The tighter the chamber, the sooner the buildup becomes a problem.

To remove the buildup, buy a brass bar at least six-inches long and 1/4-inch in diameter. Brass cannot harm the steel of your barrel. File the end on a sharp angle, so you have a curved point on it. Use the point to scrape the flat powder out of the chamber, and to dig the packed crud out of the front of the chamber. Since the powder residue is very abrasive, you will have to sharpen this rod frequently, and keep it clean. Otherwise the abrasive residue may harm your barrel.

As an aid in cleaning the chamber, dedicate a rod and brush to each caliber. If you take a brand-new brush for your caliber, it has just enough extra diameter to scrub the chamber. But the first time you push it through the bore it will flatten just a bit, and lose its bite in the chamber. To keep your dedicated chamber brushes from flattening, put a collar between the brush and rod to prevent running the brush any deeper into the barrel than the chamber. The size and thickness of the collar don't matter. Drill a hole through the collar just large enough to pass the threaded end of your brush. Use an oversized cleaning rod that is large enough in diameter to stop your collar from sliding away from the brush. Slip the threaded end of the brush through the hole, screw the brush into the rod, and now your chamber brush won't get flattened.

Powder also builds up on the slide. On all pistols the slots behind the breech face, where the ejector rides, will get coated with powder. Brushes can only get so far into these slots. On the 1911, the locking slots of the slide will collect crud that has to be removed.

Large amounts of powder residue will collect where the barrel rests on the frame. The residue may even get packed into a hard, flat mass similar to that found in the chamber.

To make a "slide hoe," use a broken aluminum cleaning rod. If you don't have one of your own, go to your local gunshop, where broken cleaning rods collect like tangled hangers in a closet. Or buy a section of aluminum rod of a similar diameter. Don't break a cleaning rod just to make this tool. File the end of the rod to a square cross-section. File the tip to a chisel point. Being aluminum, your hoe can't harm any steel. Scrape the crud out of the nooks and crannies where brushes can't easily reach.

A range rod is a brass or aluminum rod (never steel!) that is just small enough in diameter to fit down your bore. Put it in your shooting bag, along with your range cleaning kit. If you run into a squib round, one that leaves a bullet in the barrel, you want to be able to remove it without going home. If you have what you think is a squib, you can run the rod up the bore (AFTER you have unloaded the handgun!) and check. If the rod stops, hammer on it to drive the bullet out. A rod too small in diameter will flex and break, or wedge against the bullet, possibly scoring the rifling.

For .40 caliber or larger, a 3/8-inch diameter brass rod works nicely. For, 38/-357/9mm, use a 1/4-inch diameter rod. For a better fit, use your lathe to turn down the 3/8-inch (.375-inch) rod to .340-inch for your, 38's. For the .44 or .45 turn down a 1/2-inch rod to .430 or .440, respectively. Or call Brownells, and order one already turned to the correct diameter.

Chapter 6 - Basic Metalworking and Minor Repair

Polishing and Filing

You're probably ready to dive in and start working on your pistols, right? Wrong. Before you begin using the cutting tools described in Chapter 3, it's a good idea for you to practice on something a little less expensive than your handguns.

Open up your Brownells catalog, and order some steel—a bar and some large flats will do. Brownells sells both in 18-inch lengths. Buy one bar in the

inch diameter. Buy two flats, both 1/8 by 1-inch. These will be your filing, polishing and grinding practice pieces. Each time you want to work on your handguns, you can pull these out of the drawer and warm up, refresh your memory, and get your touch back.

If your area has large gunshows, start cruising the aisles looking for a dead slide. Emphasis on dead; you are not looking for a replacement slide for your 1911 (the most common one out there), but a slide that has been used up and can no longer serve its original purpose. Look for a slide that's just too rusted, or bent, or cracked. You may see one with the locking lugs set back (The engagement surface will look notched or somehow damaged. See Chapter 18 for a complete explanation) from too many hot loads or an incorrectly fitted barrel.

Expect to spend around \$20, far less than the \$200 a perfectly good new replacement slide would run. You can practice on this slide (even if you don't have a 1911) to your heart's content, safe in the knowledge that any mistakes you make are to a \$20 investment, and will never see the light of day.

Now you can begin practicing.

Your first polishing drill will be on the rod. Place it in your vise. Start with a 1-inch strip of 180 grit cloth. Pick an area somewhere in the middle of the rod, hold the cloth taut and begin polishing. Use a gentle shoe-shine motion. How you hold your polishing cloth determines how much of the rod (or the top of your slide, when you get one) gets polished. With the cloth taut you should be polishing only the very top of the curved surface of the rod. Check your work. You are using a shallow angle of departure—the cloth, held taut, barely deviates from the 180-degree plane running along the top of your bar and parallel to the floor. Polish until the area is bright. Observe the difference between the original surface and your polished surface.

Now move to an unpolished area and change your grip. This time hold the ends of the cloth down below the edge of the rod, at about a 45-degree angle of departure. Gripping the cloth this way will allow you to polish half the rod's diameter. Use the same shoe-shine motion and polish again until the area is bright. Stop and compare the two spots you've polished. The second one will be much bigger than the first.

Stay with this larger polished surface. Coat it with Dykem and move up to 220 grit. Take a few light passes, and then wipe the surface clean. Notice how the Dykem remains in the deepest marks of the 180 grit cuts. Apply more Dykem, move one hand forward of the other, and polish at an angle to the previous work.

Try different grits, and change angles each time. Work your rod until it approaches a mirror finish.

For your second drill, fire up your bench grinder and cut a shallow gouge in the polished surface of your rod. Place your rod in the vise. Start on the gouge with the 180 cloth. To polish only the gouge and its near vicinity you will need to use a shallow angle of departure. Hold the cloth taut. Polish the gouge out. Change grits and angles as necessary to achieve a finished surface. Now look at your work, including the areas adjacent to the polished-out gouge. See how the surface is dished? Look for this dishing when checking used handguns for quick (and poor) repairs.

Gouge a different part of the rod. This time, take the rod to your welder, and have him fill the gouge with soft steel. With your 10-inch Second Cut file, file the weld down. This filing should be done in a series of flat motions. You should not file the entire weld at any time. Do not tilt the file or flex it over or around the weld. Do not file the original rod. Instead, create a series of flat surfaces in the weld, each at an angle to the next. Once your series of filed flats is just about down to the rod surface, change to your Swiss pillar file. Now start using a rounding motion to blend the flats together. When the flats are blended, switch to the 220 grit cloth. Begin polishing, in a shoe-shine manner, and an angle of departure just deep enough to cover the weld plus 1/4-inch of rod surface. Polish with the 220 until the weld outline disappears, then switch to finer grits until you reach the level of shine you would want on your slide. Done properly, the surface will not be dished.

Weld up gouges and dress them down! If you simply polish out the gouge, the surface will be dished and wavy.

Some drills you do, and some drills you buy. Before doing any flat stock polishing drills, let's look briefly at drills that go in the drill press.

There is no such thing as a "standard" firearms thread, and you cannot buy any firearm screws you may need at the local hardware store. The most common thread sizes used in firearms are, in order, 6-48, 8-40, 10-32. What do these numbers mean? Some people would say "Just about anything!" and they'd almost be right. The 6-48 thread, (pronounced "six, forty-eight"), refers to a number six screw, with 48 turns to the inch. Because the system of naming screws and pairing drills with screws is so, (sorry I can't help myself) screwy, the designers of firearms have tried as much as possible to not use screws. Still, you will find screws on your pistols, and you will occasionally need to drill them. The 1911 has four screws, (and, true to form, they are not among the three most common sizes mentioned above) each threaded into a bushing screwed into the frame. You will have to deal with these, and others.

In order to tap a hole for any screw, you have to make just the right diameter hole. Too narrow, and you can't get the tap started. Too wide, and the threads will not hold. A tap has to be just right, like Goldilocks' porridge. For a 6-48 you use a number 31 drill. Why are they named that way? I have no idea. Whoever came up with this arcane system must have been out of his mind, because no one in his right mind would assume that for a "number six" screw you would use a "number thirty-one" drill. Check the chart for what drills go with what screws. Don't assume you can pick the right drill by eye. Don't bother trying to memorize the chart. Just follow it.

Place one of your steel flats on the bench. Mark a location, 1-inch from the end, and in the middle of the 1-inch flat. Centerpunch the spot. Clamp the flat in the drill press, and drill the hole with the number 31 drill. Put the flat back in your vise. Pick up the 6-48 tapered tap and lock it in the tap wrench. With the fingers of your left hand hold the body of the tap wrench upright on the steel. You must hold the wrench straight up. To check your position, move your head from one side of the steel to another, and adjust the tap until it is vertical. With your right hand, simultaneously press the tap wrench down as you rotate it. Use your left fingers to guide the tap and keep it vertical.

If, as you turn the tap, you do not use enough downward force, the tap will simply ride along the edge of the hole, instead of biting in. Once you press hard enough you will feel the teeth of the tap cutting the steel. After a couple of turns, stop. The teeth have been cutting steel and the spirals of cut steel have been building up in the flutes of the tap. Turn the tap backwards half a turn to break these spirals, then continue cutting steel. On a deeper hole, or on harder steel, you will have to back the tap up several times before you finish tapping the hole.

Use the tapered tap for holes that go completely through. The tapered tap has the first 8 or 10 teeth tapered. Blind holes, which are holes that do not go completely through, require a plug tap and then a bottoming tap. The plug has the first 3 to 5 teeth tapered, and the bottoming tap has only the first tooth tapered.

Look closely at your tapped hole. Notice the shoulder. That shoulder was not created by the drill. It was the tap which forced the shoulder up. If you are going to bolt something to the hole, say a scope mount, the shoulder can get in the way. Take your Swiss pillar file, and attempt to file the shoulder down. Unless you have superhuman patience, and an unbelievable touch, you'll find you can't. You may also find that you have filed the flat surface around the shoulder, something you do not want to do. Instead, take a drill larger in size than the hole you drilled (the size isn't really important) and, using only your hands, turn the drill in the hole. You can get rid of the shoulder and very slightly bevel the hole with only a few turns of the drill bit. If you use a very light touch, you can even do this in the drill press.

Another way to eliminate a shoulder is to prevent it from coming up at all. After drilling your hole, and before tapping, switch to a larger drill and very lightly "kiss" the hole with the larger drill. You want to do this just enough to offset the shoulder that your later tapping will kick up.

Take your flat steel and clamp it in the vise vertically. Leave two-inches sticking up above the top of the vise. With your 10-inch second cut file, file the top edge of the steel. You will feel some vibration as the file cuts the steel. Two-inches of steel sticking out of the vise makes proper filing impossible. If you press harder you will start cutting a striped pattern in the steel. Because of the vibration and the force you are applying, the file is jumping along its teeth and cutting the striped pattern. Ease up in the force you use, and the pattern (but not the vibration) will go away.

Unclamp the steel, and move the top edge down so only half an inch protrudes from the top of the vise. Now there is no vibration when you file, and no matter how hard you lean, the pattern you saw before will not reappear. When the part you are filing is clamped correctly in your vise, it is the force of your pressure, and the rigidity of the part, which determine the finished surface of your cut. As they should.

With your hacksaw, cut three-inches off one of your flat pieces of steel. Bevel the sawn edge with any file. You want to knock off the burrs. Tape a piece of 220 cloth to a hard, flat surface. You'll be wetting the cloth with mineral spirits, and, unfortunately, the mineral spirits will dissolve the glue on most tapes. I find large pieces of duct tape hold together long enough to allow me to finish a job. The best surface to tape to is a large piece of steel. If you don't have one glass will do. Be careful, as the glass will break if you do not support it fully. Wet the cloth. Pick up your de-burred three-inches steel, and put it down flat on the cloth. Push it away from you. Pick it up again and push it away again.

Simply wiping the steel back and forth, and back and forth, instead of lifting and placing and pushing, will produce a curved grain to your polishing.

Look at the surface you have just correctly polished. It probably looks uneven. The "flat" steel you've been working on is not flat. Unless the manufacturer used a surface grinder to finish the surface, there is no such thing as a "flat" piece of steel. We just call it flat for our own convenience.

You must remember that flat surfaces are not flat when you go to polish your slide. I refer to this as "Hibbert's Law," named after the shooter at our club who, after an exasperating session trying to polish his 1911, exclaimed, "Nothing is straight, nothing is flat, and nothing is where it's supposed to be."

Take out your dead slide. Even if you are going to be working on a Beretta or Glock, using a 1911 slide for practice will work just fine. Plus, they are easy to get. At any gun show you will see a hundred dead 1911 slides for every deceased Beretta or Glock slide.

Take a drift punch and your hammer, and drift the rear sight out. Depending on how long it has been assembled, this may take some hammering. Scrub and clean the slot and sight. Re-insert the sight and drift it back to center on the slide. When, in Chapter 13, you go to change sights on your operating 1911 (or other pistol) you can check the fit, and practice filing the slide sight slot on this dead slide.

Look at the front of the slide. The front sight, if original, will be a small blade staked into a slot in the slide. You cannot remove this sight without destroying it. The fast way to get rid of it is to clamp the sight in your vise with the slide upside down, and then rotate the slide to twist the sight off. If the spectacle of a twisted lump of metal that used to be your sight lying on your bench disturbs you, you can use the sight to practice filing. It takes a delicate touch to file the sight off without touching the slide.

Either way, you will be left with the sight stub in the slot. Take a narrow drift punch and punch the stub, called a tenon, out of the slide from the top.

Tenons come in three sizes. The original, or narrow tenon, held sights just fine when sights were tiny little, thumbnail-sized things. Larger sights were prone to come off the slide when secured by a narrow tenon. When Springfield Armory began production of 1911 pistols, they increased the tenon to the medium tenon. Colt stayed with the narrow tenon until they began production of the Series 80 pistols, when they went to the wide tenon. The wide tenon is the full width of the sight, .125-inch.

When modifying the sights on your slide you must pay attention to the width of the new sight's tenon and the width of the original slot. They must match. It is not possible to stake a sight to a slot larger than the sight's tenon. Nor can you widen a slot that is too narrow for a tenon.

Now practice polishing, using your dead slide. Apply Dykem to the sides. Begin by polishing the slide sides with 220 cloth taped to a hard, flat surface. Once you have polished the high spots, you will have to take a separate piece of the same cloth and polish by hand. To do this, clamp the slide in a padded vise with the flat up. Use your thumb, wrapped in cloth, to polish the areas the flat surface polishing could not reach. Apply more Dykem and switch to a finer grit. Repeat the process, polishing flat, and then polishing by hand to get the lower areas.

When using cloth, remember that it has one great strength. Properly supported and backed, cloth will conform to the general shape of whatever you are polishing. In this case, your thumb is the backer. If your thumb becomes tired, use a narrow piece of wood with the end rounded.

You may be thinking that's a lot of work- switching from flat-backed to thumb-backed cloth, and steadily moving to finer and finer grit as you polish your slide. You may wonder why you shouldn't just use a coarse grit and polish the slide side until it is truly flat. The truth is, it is more work to use a coarse grit and polish flat. And you would be removing way too much metal from the slide. The slide stop hold-open notch is not the full thickness of the slide side. If you take too much metal off the sides of the slide, this notch will be too shallow. It will not long withstand the impact of stopping on the hold-open lever. Eventually it will round off, and your slide will not lock open when the magazine is empty.

Before starting any project on your good slide, take out the dead slide first. Practice on it. If you decide to lower the ejection port of your operating 1911, practice on the dead slide. If you want to hard-fit the slide and frame, practice squeezing the slide on your dead one, not the good one. If you chew up your practice slide until there's nothing left to it, just go out and get another. Use it to protect your good slide.

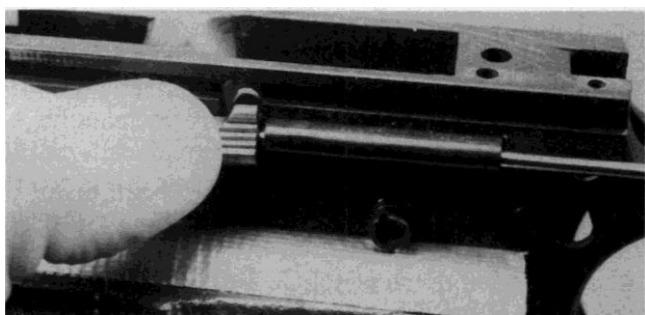
Projects:

Safety and slide stop engagement

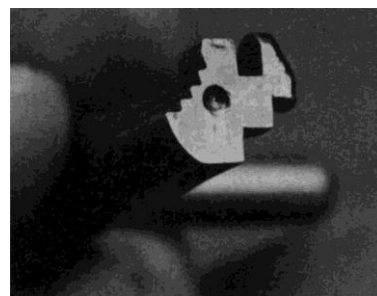
On the left side of the frame of a 1911 is the plunger tube. Inside it rest the plungers and spring that hold the slide stop and thumb safety in their places. Unfortunately, they don't always work. On some pistols the slide will lock back before the ammunition is expended. On these particular pistols the slide stop will pop or vibrate up and hold the slide open before you are out of ammo. On other pistols the safety will bounce up enough to engage the sear. This can be dangerous. When you release the trigger, the sear may not return to rest. I once had to repair a pistol whose safety would pop up and bind the sear in such a way that if you pushed the safety off, the sear released, firing the pistol. To say this was startling is an understatement.

If the slide stop or safety do not behave on your pistol, you must fit them properly.

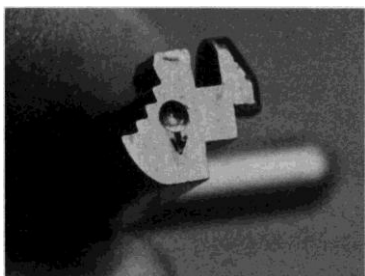
Let's start with a malfunctioning slide stop. Make sure the pistol is empty. Take the slide off of the frame. Remove the thumb safety, plungers and spring. Now put the slide stop back in the frame. Clamp the frame in a padded vise, or slide it on your holding bar. Take the Krieger dimpling drill, and chuck the fat end in your variable-speed drill. Snake the narrow end into the plunger tube, and be sure it comes out the other end. If it doesn't, you'll be drilling on the internal shoulder of the plunger tube. This does not help.



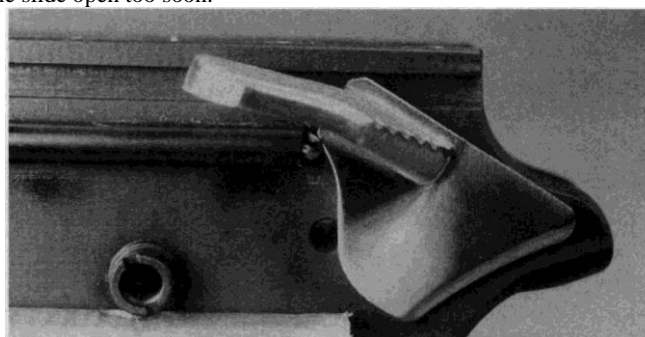
Hold the slide stop down while you use the dimpling drill



Dimple just enough to keep the slide stop from bouncing up and locking the slide open too soon.



If the slide stop is dimpled too much, use a fine round file to notch out the bottom of the dimple, in the direction of the arrow, the circle becomes a teardrop.



If your thumb safety comes off too easily, pull the dimpling drill through the plunger tube and attach the drill to the other side. Carefully drill the safety until it is harder to push off, but not too hard.

Hold the dimpling drill tip against the slide stop face, and push the slide stop down with your left thumb. Press the stop down with a good amount of force, as you want to hold it in place when you turn on the drill. Drill for no more than a couple of seconds. It is much better to under-drill than to over-drill the slide stop. Pull the drill out, pull out the slide stop and look at the end of it. On the end of the slide stop you should have a small dimple, no larger in diameter than .070-inches.

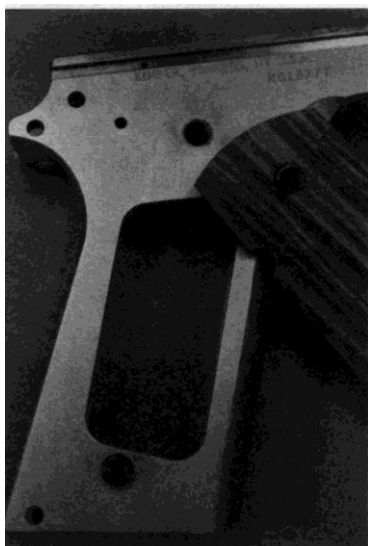
On the next trip to the range, check to see if your slide stop is fixed. If it isn't, and your pistol is still locking open prematurely, you have to repeat the process and drill the dimple slightly larger. Don't make the dimple too deep, or the pistol will fail to lock open even when it is empty. A deep dimple can be corrected, but you will have to prevail upon your dentist for used dental drills. To correct an over-dimpled stop, take a cylindrical dental drill. Install it in your Dremel tool. Work from below the dimple. Position the drill at a shallow angle and cut a ramp out of the dimple. The ramp will let the slide stop ride out of the dimple.

The thumb safety that pops up can be more than irritating, it can be dangerous. To fix this problem, remove the slide assembly from the unloaded 1911. Cock the hammer, and remove the thumb safety, and the spring and plungers from the plunger tube. Either clamp the frame in a padded vise, or use your frame holding bar to secure the frame. Put the narrow end of the Krieger drill through the plunger tube, and pull that end all the way forward. The drill should now be sticking past the front of the frame, with the fat end completely inside the plunger tube. Reinstall the thumb safety. Chuck your variable speed drill onto the end of the drill bit. Hold the thumb safety down, turn on the drill, and push the drill into the safety. Again, it is better to under-drill than over-drill.

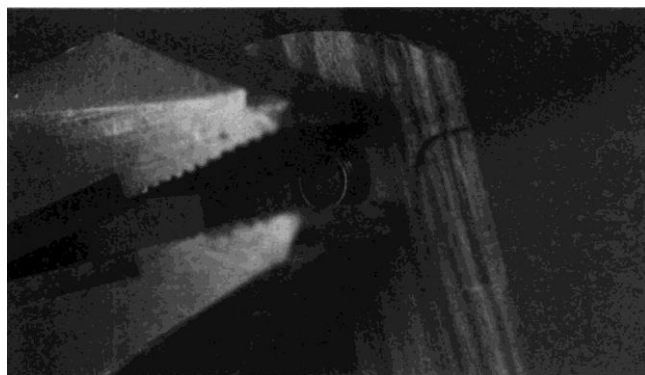
Turn the drill off. Remove the thumb safety, un-chuck the drill and pull it out of the plunger tube. Brush the drilling chips off the safety, reassemble the pistol, and on your next range trip check the thumb safety function. If it still pops up, you need to drill more. If you over-drill, the safety will be difficult to press into the safe position. Correct over-drilling with a round needle file, filing the bottom of the dimple you have drilled. By breaking the bottom edge of the dimple you ease the work your thumb must do in pushing the safety up.

1911 Grip Screw Bushings

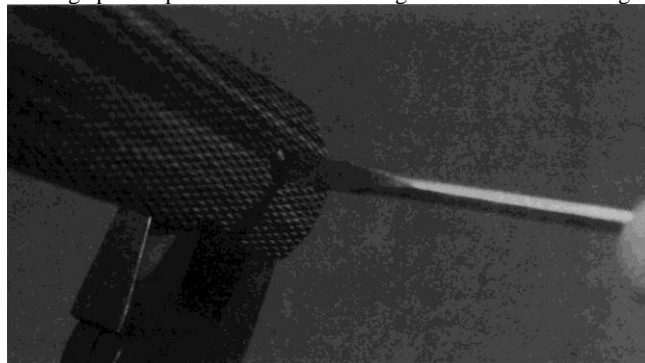
The grips on a 1911 are held on with screws, and these screws thread into bushings which are themselves screwed into the frame. Why not simply screw the grip screws right into the frame? Good question. My suspicion is that John Moses Browning was in one of his "belt and suspenders" moods. If you lose the screws, the bushings still keep the grips from shifting, and a piece of string or tape will keep them from falling off the frame.



Sometimes when you remove the grip screws, a bushing will come with one of them. Don't worry, we can salvage this without having to buy a replacement.



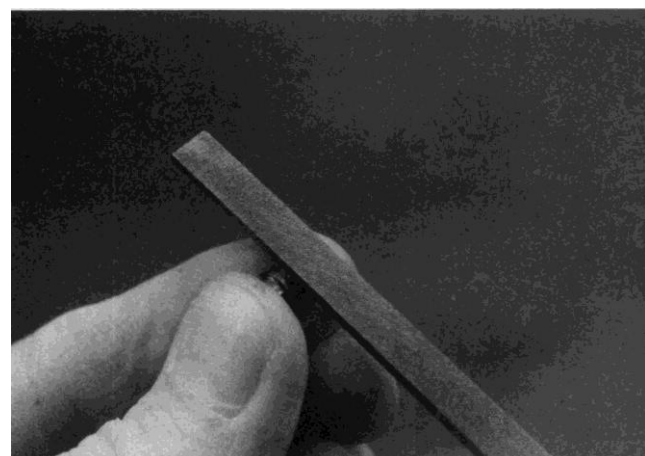
Use a large pair of pliers to hold the bushing for removal from the grips.



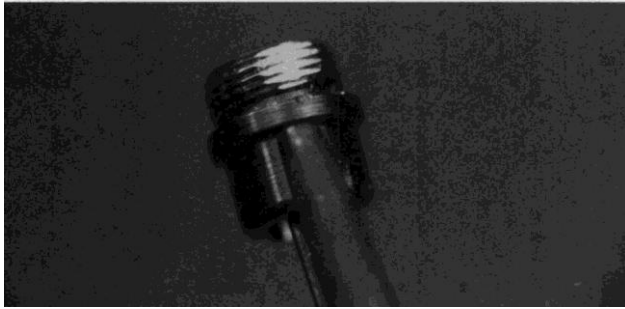
Hold the bushing tightly. If it slips in the pliers you will not be able to salvage it. Remove the screw from the bushing.



The pliers will mar the threads where the bushing was held.



File the burred threads so you can replace the bushing.



This is what the tiled bushing will look like. Don't worry, there are enough threads to keep it in the frame. You can only do this to a bushing once. The second time it is stuck you must replace it.



Replace the bushing, using some Loctite to secure it.



Clean the threads with a tap before replacing the bushing.



The grip screw bushing staking tool slides into the magazine well and rests against the lower bushing. Then slide a drift punch through the upper bushing and rest it in the cup in the bushing staking tool. Strike the punch with a hammer.

There will come a day when you go to remove the grip screws, and find that you have unscrewed one of the bushings right along with it. In your hands will be a screw-grip-bushing sandwich. You can ignore the attached bushing, and just screw it back into the frame when you put the pistol back together, but it's better to fix it. The bushing threads are very fine, and if you continue to screw the bushing in and out you will eventually damage them. The trick is to remove the bushing without destroying it.

You will need your largest pliers, a screwdriver that fits the grip screw slot properly, a screwdriver that fits the bushing slot properly, your Swiss pillar file, Loctite, and two taps. The first tap is a grip screw bushing tap, size .236-60. The second tap is the grip screw thread size, .150"-50. Both are available only through gunsmithing supply houses such as Brownells.

Take your pliers and grasp the bushing by its exposed (threaded) end. Even though you will mar the threads, hold the bushing as tightly as possible. If the pliers slip, you'll have to replace the bushing. Better to mar the threads. With a properly-fitting screwdriver, turn the grip screw out. It will resist. (It is stuck, after all.) These screws almost always come free with a snap. As soon as you feel the screw release, relax. Ease your death-grip on the bushing, and remove the screw without further struggle.



With a drift punch and a staking tool you can stake your grip screw bushing in place. I prefer Loctite. I have never had a Loctite-ed bushing come loose.

With the screw out, you'll have to repair the bushing. Use your file to remove the marred portions of the bushing threads. With your tap, clean out the threads in the frame. You will find that an amazingly large amount of years-old gunk and crud can come out of a very small recess. Try the bushing in the frame and make sure it screws in smoothly. If it doesn't, either you haven't fully filed off the marred portions of thread on the bushing, or you haven't completely cleaned out the frame threads.

Once the bushing will screw down all the way without requiring force, unscrew the bushing, and degrease both it and the frame threads. Carefully place a small amount of the highest grade of Loctite you have on the threads. Screw the bushing in and snug it down firmly. The traditional method of securing the bushing is to stake it in. For this, a star shaped wedge is placed on the inside of the bushing. By sliding a punch through the other bushing and striking it with a hammer, the back of the bushing is peened to the frame. I have had a staked bushings come loose. I have never had a Loctite-ed bushing come loose.

Be sure to wipe the Loctite out of the inside of the frame! If you use too much, whatever is left-over on the inside of the frame can run into other parts. You can literally glue the trigger bar in its slot. Not good. I have even encountered 1911's with their magazine glued into the frame, from just a stray drop of Loctite!

Give the Loctite a few minutes to set before working on the inside of the bushing. You'll find a lot of gunk in there, too, since this is where the screw was stuck. Use the grip screw tap to clean out the crud. If you don't clean out the threads you'll just have the screw stuck again the next time you go to clean your pistol.

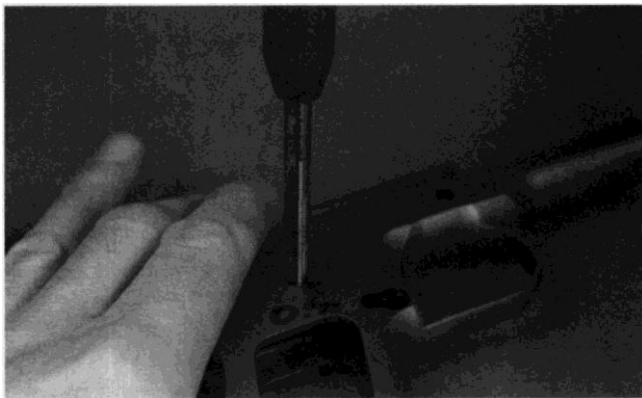
When you reassemble, put a drop of oil on the threads of the grip screws.

Sometimes, when a bushing accidentally comes out along with its screw, it strips the bushing threads. You remove the bushing from the grip screw the same way, but you can't re-use the bushing. The threads on the bushing, and in the frame, will be destroyed. You'll have to re-tap the hole. Buy an oversize bushing and a size .255"-60 tap.

Place the stripped frame on a flat padded surface. Start the tap, and using considerable force, re-cut the threads. The frame steel is relatively hard, the hole is oversized, and the tap has a short taper to it. You will have to lean on the tap handle. Once you have cut the threads, check the fit of the new bushing by threading it in. When you can screw it all the way down, unscrew it, degrease and Loctite it, and screw it back in. Snug it down.



If the frame threads are stripped you will have to replace the old bushing with a new over-sized one. The frame has to be re-tapped to the new thread size.



Stripped threads must be re-tapped to the next size larger.



Once you have replaced the bushing, clean the screw threads with a tap. Otherwise, you'll be faced with the same problem soon again.

What if (1) you go to remove the grips, (2) the bushing comes along with the screw, (3) it strips the threads as it comes out, and (4) you realize it's an oversize bushing already? This is a tough repair. You can't go up another thread size—no one makes an over-over sized bushing and tap. In 15 years as a Professional Gunsmith, and 12,000 guns, I have run into this problem just once. You probably won't, but for the three people who do, here is how to fix it.

Jump ahead to Chapter 8, and read up on silver-soldering. Take the stripped bushing, disassemble the frame, and degrease the frame and bushing. Flux the bushing and its frame hole. Heat and silver-solder the bushing into the frame. With care you will not have to clean up excess solder, but you will have heated the frame enough to ruin its bluing or plating.

The bushing will now withstand the force of a grip screw. Be sure to use your grip screw tap to clean out the inside of the bushing, or the screw will bind and stick. Those aspiring pistolsmiths who want the extra credit can file down the bushing, drill out its center to the proper hole size for the standard bushing threads, and re-tap the hole for a new, original-sized bushing. You must Loctite this new bushing in. If you try to stake it you will break out your silver-soldered repair.

S&W Crane polishing

The crane, a large bird that is beautiful in flight and amazingly clumsy in landing, is also the axis of rotation of the cylinder in your revolver. Drag on the crane can increase the force needed to pull the trigger, and make for a gritty feeling trigger pull. I have no explanation for the awkward landings of the bird.

Polishing the crane is one part of your trigger job. Remove the front sideplate screw of your S&W revolver, and pull the cylinder and crane out of the frame. Pull the crane out of the cylinder. Scrub and degrease the crane, and then clamp the base of it in a padded vise.

The barrel that the cylinder rotates on should be horizontal, and sticking forward out of the vise so you have clearance all around it.

Do not use coarse cloth! Coarse cloth would even out the whole surface of the crane, reducing the diameter of the barrel, and introducing wobble into the rotation of the cylinder. A wobbly rotation can harm accuracy. If the crane is dragging, you want to polish only the high, or bearing, spots. Apply Dykem to the barrel. Use your 400 cloth in a shoe-shine manner, with the ends of the cloth coming off the barrel parallel to each other. Polish all around the barrel just enough to wipe off the Dykem. Inspect the surface closely. You should be able to see the areas you have polished. Do not worry that you have not gotten all of the surface. These low spots are not the problem. Switch to your 600 cloth, and polish the high spots to a mirror finish. Scrub, degrease and reassemble.

Endshake in the S&W revolver

If your Smith & Wesson revolver has seen a lot of use it may have developed a condition known as endshake. Does the cylinder, after being closed and locked in place by the locking bolt, move forward and back on the crane? In extreme cases the cylinder can actually bind on the back of the barrel extension, or move so far forward that the firing pin cannot fully strike primers, causing misfires.

Endshake is not good.



To remove endshake and align the crane on your revolver, you need a few simple tools.



Check cylinder gap with the cylinder pushed back. Record the measurement.



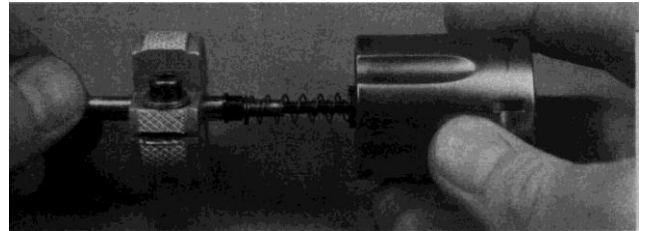
Check cylinder gap while pushing the cylinder forward. If this is less than the gap with the cylinder pressed back by .003-inches or more, remove the endshake.

Years of use and thousands of rounds have loosened the fit of the crane to the cylinder, causing play. In order to remove endshake, you must remove this play. There are two methods. You can shorten the hole, or you can lengthen the crane.

For the first method, you need a set of feeler gauges, headspace gauges, crane bushings or shims, and your Swiss pillar file or medium-fine stone. If you do not have headspace gauges you can get by with unfired or once-fired empty cases. The factory-approved second method, of lengthening the crane, does not use crane bushings or shims. Instead, a crane stretcher, which looks very much like a modified pipe-cutter, and a crane alignment gauge are used to squeeze the crane, stretching it and making it longer.



Tighten the Wessinger ejector rod clamp firmly. If it slips you will not be able to unscrew the ejector rod.



Use the clamp to unscrew the ejector rod.



Place a Power bearing washer in the cylinder to remove endshake.



Use the crane to press the washer into the tunnel.

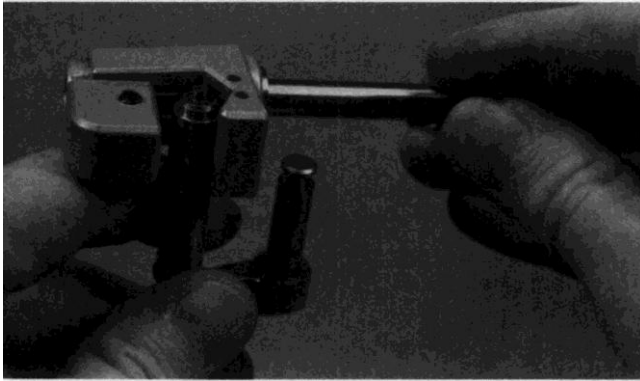
With either method, begin by removing the crane and cylinder from the revolver. Pull the crane from the cylinder. Unscrew the ejector rod, and pull the rod, centerpin and springs from the cylinder. Pull the ejector star out of the cylinder. As you take each part out, look at it closely to remember how it fits with the others.

For the first method, take one of your .002-inches Power crane bushings and drop it down into the cylinder center hole. Push it to the bottom and make sure it is flush. Put the ejector star back in the cylinder. Make sure the ejector star slides through the bushing without pushing it out of place.

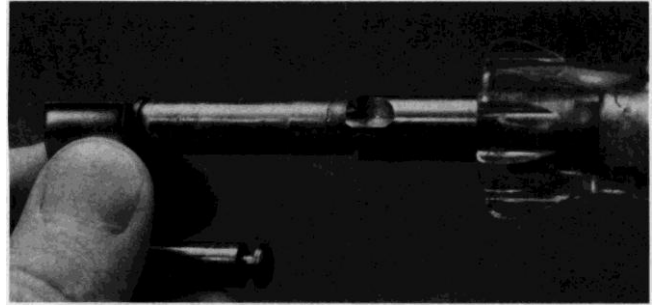
Put the crane back into the cylinder, and put the crane and cylinder into the frame. Attempt to close the cylinder. If you can, check endshake. Still there? Pull the cylinder apart and put another bushing in. If you need more than two .002-inch bushings, pull them out and put in a .004 bushing, then another .002. Continue putting in bushings and checking fit until you cannot close the cylinder. Pull the last .002-inch bushing out. You should be able to live with this fit. Reinstall the centerpin, ejector rod and their springs. Tighten the ejector rod. Check cylinder rotation. It should rotate smoothly, without binding.

If you find that a full stack of bushings eliminates endshake when the cylinder is closed, but that the cylinder no longer rotates easily, or, that when the cylinder rotates easily, you still have too much endshake, you'll have to do additional work. In these cases the fit needs .001-inch of adjustment. You can stone the barrel end to gain this. Take the cylinder and crane out, pull the crane from the cylinder and use Dykem on the end of the crane barrel. If you have left the cylinder short one bushing, put that last one back and reassemble the cylinder.

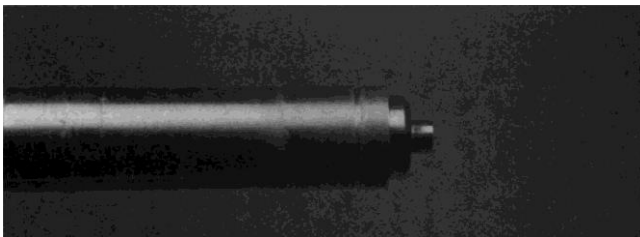
Rotate the cylinder once. Pull the crane back out and look at the end of the barrel. Almost always, you will find that the Dykem on the crane barrel end has not been worn off evenly. One part of the end is higher. Stone or file the bright spot where the Dykem was worn off. Apply more Dykem and when the Dykem is dry, try again. In a couple of tries, you should have the cylinder rotating smoothly and free of endshake. If you have filed religiously on your practice bar and have acquired a good touch, a single pass with the file will do the work of two, three or four passes with the stone. If you file too much, though, you will have to add another bushing to the stack.



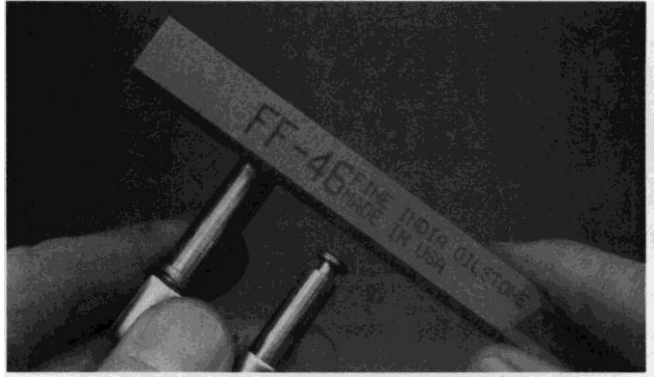
Place the Power crane swager on the crane near the end. Be sure the alignment tool is inserted, or you will collapse the crane.



If you over-swage the crane, use a Power reamer to shorten and square the crane end.



Turn the crane swager until a line appears.



Use a stone to dress down the edges of the line, if the crane will not re-enter the cylinder.

The factory method does not depend on bushings. Slide the crane alignment tool into the crane barrel. This tool prevents the crane stretcher from crushing the barrel, and forces the crane to lengthen. If you forget the alignment gauge, you will squeeze the crane barrel, the ejector rod will not pass through the narrower section, and you'll have to send the revolver back to the factory. Put the crane stretcher over the crane barrel and tighten the adjustment nut. Rotate the crane stretcher once around the barrel.

Take the stretcher off, the alignment gauge out, and check the crane fit. If there is still endshake, put the alignment gauge back in, put the stretcher back on, and after tightening, give the stretcher one turn. Do not go too far, or you will have to stone the barrel end back. When you get to the point the cylinder closes, but binds on turning, apply Dykem to the end of the crane barrel as before, and see if it has stretched unevenly. Stone it even, until the cylinder rotates freely.

With either method, once you have a cylinder that rotates freely without endshake, you must measure the clearance of the cylinder, front and back. Begin with the front.

With the feeler gauges, check the gap between the front of the cylinder and the back of the barrel. Removing endshake expanded this gap. The factory specifications for the minimum gap have been constant for decades: It cannot be less than .003-inches for continued reliable function. Less than this, and the powder residue buildup on the front of the cylinder and back of the barrel will cause the cylinder to bind. The maximum has varied. I was once informed by a S&W factory representative that a gap less than .013-inches was acceptable. I told him in indignation that if he shipped that revolver back to me with a gap of .012-inches, both the customer and I would reject it and send it right back to him. It showed up with a gap of .006.

S&W now considers a gap of .003 to .007-inches perfect. If you set back your endshake and the gap falls in this range you are going to be a happy shooter, indeed. Up to .010-inch you will still do fine, although the blast of powder out of the sides of the gap can scorch your shooting bench or mats. Beyond .010-inch, you will find that other shooters may object to the blast, and they may experience particles being blown their way from your now-excessive gap. A revolver with so many rounds through it that you had to remove endshake, and ended up with a gap this large, probably has serious wear in the forcing cone. In this case, you must set the barrel back, a job covered in Chapter 20.

Now measure the rear of the cylinder. If you are using headspace gauges, the cylinder should close and rotate on all the chambers, with the “go” gauge in place. It should not close or rotate on any chamber with the “no-go” gauge in place. Without headspace gauges the job is a bit more difficult. Measure the rims of a bunch of de-primed cases, and find six that are the same thickness. Put these in the cylinder, and then rotating each chamber in line, measure with your feeler gauges. The total of case rim thickness and feeler gauge you can fit between the rim and the firing pin plate must not exceed the maximum headspace figure. The .38 Special, for example, has an allowable headspace range of .060 to .066-inches. If you have a case with a rim of .061-inches, you must not be able to fit more than a .005 feeler gauge between the case and the firing pin plate. This hardly ever happens. Usually, when you remove endshake you end up with a headspace range of .059 to .063-inches. Since the cartridge rims are slightly undersize, .056 to .060-inches, things work out fine. You just want to measure to be sure.

Removing frozen screws

If you work in firearms long enough, you will run into screws that refuse to budge. With the correct screwdriver and the proper force, a screw should move. If it doesn't, stop. Go through this checklist: Is the screw a properly-fitting screw? When was the last time this screw was moved? Has Loctite been applied? If you don't know, is it a screw that is likely to be locked in place? (The most common places you will run into screws locking in place will be on scope mounts. People who don't know how to properly tighten a screw will use Loctite when it's not needed.)

You must proceed with caution or you will mar or strip the screw slot, making a difficult job that much more difficult. Do not let anything slip. The screw or even the firearm will be damaged.

Double-check that you are using a properly-fitting screwdriver. If the screw is locked in place with Loctite, use a propane torch to break down the Loctite. You must be careful. The strongest grades of Loctite will withstand 400-degrees Fahrenheit. At 600-degrees you will heat-damage the bluing.

If the screw is frozen, but not locked in with Loctite, heat will have no effect. Put the firearm on your bench so the screw is level, and place a drop of penetrating oil, such as Liquid Wrench, on the screw-head. Let the oil work into the screw for an hour, a day, or a week, if you can. Now try again with a screwdriver.

Some people prefer to work horizontally, others vertically. I'm a vertical person. I set the handgun on top of the padded vise, with the jaws open enough to let the frame fit in the droop of the padding. I hold the screwdriver vertically and place it into the slot. My chin rests against the end of the screwdriver's handle while I use both hands to turn the screwdriver. In this way I can exert maximum force and still feel for any movement of the screw. The screw usually lets go with a small snap. Sometimes it doesn't. A variation of this involves the drill press. Clamp the firearm to the drill press table. Put a driver bit that fits the screw in the drill press chuck. Make sure the drill press is not just turned off, but unplugged. Lower the drill press head, line the blade of the screwdriver up with the slot. Using the drill press to keep the screwdriver blade firmly in the screw slot, turn the drill chuck by hand. If the screw is completely immovable, or the screw slot has already been damaged enough that you cannot get the screwdriver to purchase, you must now resort to extreme measures.

Extreme measure #1: Re-cut the screw slot.

Position a cutoff wheel in your Dremel tool. Grind the wheel down to a diameter small enough that you can re-cut the screw slot without touching the frame of the firearm or the base of the scope mount. This method works better with large screws than with small.

Extreme measure #2: Drill the screw.

Clamp the handgun in your drill press. DO NOT attempt this with a hand-held variable speed drill. If you simply attempt to drill, the drill will flex against the screw slot, “walk” and drill places you don't want drilled. So—clamp the handgun in your drill press. Use only a center drill. Drill the center of the screw down just far enough to drill off the head. You do not have to match the drill to the screwhead diameter. So long as the drill is larger than the threaded portion of the screw, when you get down to the threads the head will come off. This method is most useful when the firearm is plated, or the part being held by the screw is aluminum.

You can now remove whatever the screw was holding on, and the screw shaft will turn out easily with a pair of pliers.

Extreme measure #3: Welding.

Take the firearm to your welder. (And for goodness sake, let him know you are coming, and why!) He can build up a post of weld on the screw, and then either weld a section of welding rod to the stub, or weld a nut to the post. Either way, the screw will turn out, and it will be intact. The screw, having been welded on its head, can be turned, polished, and have a new slot cut. You won't need to replace the screw. What you will need to do is repair anything damaged by the heat of the welding process. Any bluing or plating will be torched off around the screw. If the screw was holding down something made of aluminum, the torch will have destroyed it.

Stuck cylinders

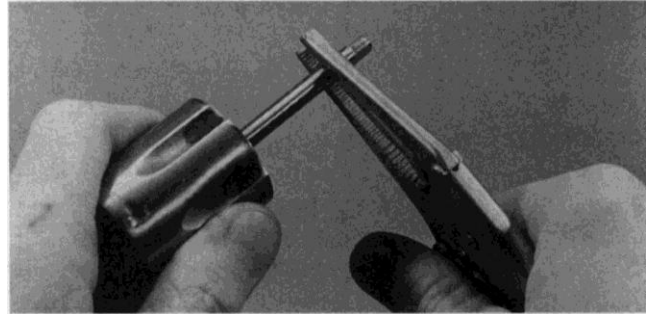
Very rarely the cylinder on a revolver won't open. Sometimes it won't even rotate. A squib round may have stopped right in the forcing cone, jamming the cylinder. To check, first look at the gap between the cylinder and the barrel. If there is a bullet across the gap, use your range rod to force it back into the chamber. Now you can open the cylinder, remove that cartridge and the others, and never, ever, use that brand of reloaded ammunition again.

When the cylinder jams on a Smith and Wesson revolver, it could be that the ejector rod has unscrewed itself from the ejector star, and now the additional length will not allow the front end of the rod to clear the front locking bolt. Push the cylinder latch forward and look at the forward end of the ejector rod. The centerpin will still be recessed in the end of the ejector rod. Unfortunately, the ejector rod sometimes unscrews when the revolver is loaded. You must exercise extreme caution!

The messy and unprofessional method of screwing the rod back is to reach in with a small screwdriver and rotate the rod. This mars the knurling on the rod's end.



To screw a loosened ejector rod back into the cylinder, wedge the front of the rod. Slip a feeler gauge between the locking bolt and the cylinder locking slot. Rotate the cylinder to tighten the rod.



Do not use pliers to tighten or loosen the ejector rod of your revolver. You will only chew the rod, and bend it.

Instead, take your chamber scraper, and wedge the sharp end of it into the gap between the ejector rod and barrel. With your feeler gauges, reach under the cylinder and push the locking bolt down out of its slot in the cylinder. You can now rotate the cylinder, and screw the ejector rod back in.

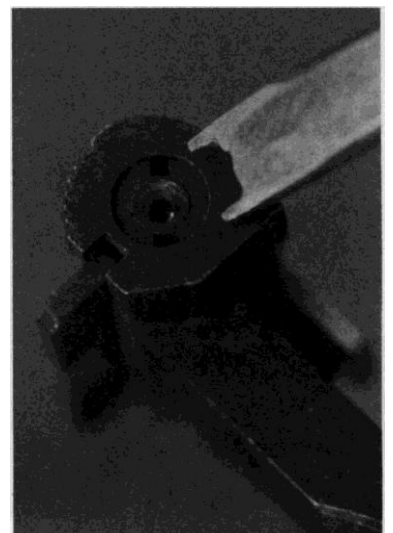
A complication: Smith and Wesson has changed its mind about whether the threads on the ejector rod should be right-hand threads or left-hand. There is a chart, but it is easier to simply try one direction and then the other. If you rotate the cylinder until it stops, but it still won't open, you went the wrong way. Wedge the scraper on the other side of the ejector rod, and rotate the cylinder the other way. Now, when it stops rotating, you should be able to open it.

If the cylinder was loaded, remove the cartridges. Unscrew the ejector rod completely. Degrease the threads. Put at least two EMPTY cases in the cylinder, more if you have them, to support the extractor star. Screw the ejector rod back into the cylinder, and tighten it as tight as you can with your bare hands. Do not use Loctite. Do not use a pair of pliers. If experience teaches you that your hand strength is not sufficient to tighten the rod against future loosening, buy a rod tightening tool. The tool is an aluminum cylinder with a hole through it and a locking screw on the hole. Slide the tool over the ejector rod, tighten the screw, and using the tool as a wrench, tighten the ejector rod. Again, use support cases to take the strain off the extractor star, and do not use Loctite.

Repairing/Replacing rear sight blades

If you drop your revolver, odds are whatever part of it hits the ground first will be marred. If the sights hit first, you will bend or break the blade. Since adjustable rear sights are more fragile than fixed rear sights, dropping can damage the entire rear sight assembly.

Modify a spare screwdriver to fit the rear sight locking nut.

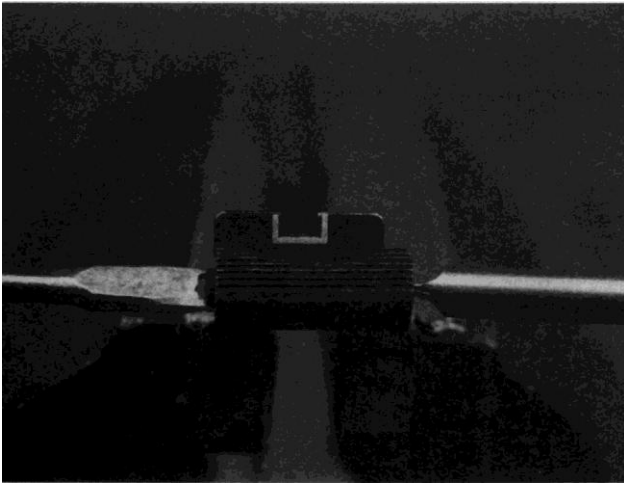


If the assembly is damaged, replace the whole thing. Remove the screw on the front of the sight assembly and slide the sight out backwards. To put the new assembly in, slide the sight foot on the bottom of the assembly into the slot milled into the top of the frame. You need to watch the foot as you slide it. Because it is square, it often needs some fussing before it will fit. Tighten the front screw down. Take your revolver to the range, and zero in the sights.

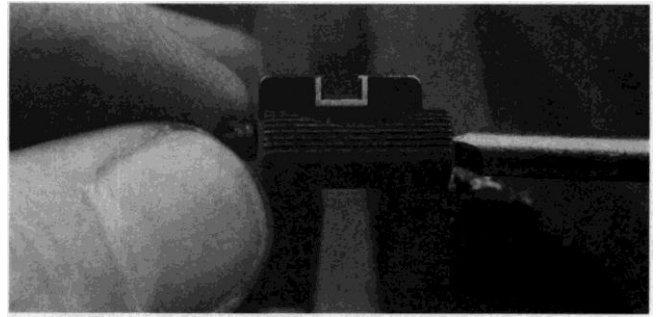
If only the blade is damaged you can replace it without having to buy a whole new assembly. You'll need a new blade and three screwdrivers. The first, an adjustment screwdriver, must fit the windage adjustment screw properly. The second, a small eyeglass screwdriver, will re-stake the sight locking nut at the very end of the process. You must buy these two screwdrivers. The third screwdriver fits the sight locking nut. You can buy or make this third screwdriver. I made mine 15 years ago, and it has served me through more than 100 rear sight repairs.

To make one, take a medium screwdriver, and grind or file the blade to a thickness of .045-inches and a width of .165-inches. Now clamp the screwdriver in your vise with only the tip sticking out, and with a cutoff wheel in your Dremel tool, grind the center out of the blade. You will end up with a horned, or two-tipped screwdriver. The two tips will fit into the slots of the sight locking nut, and over the sight screw that protrudes from the nut. Take the screwdriver out of the vise, put your padding back in, and put the unloaded revolver in the vise.

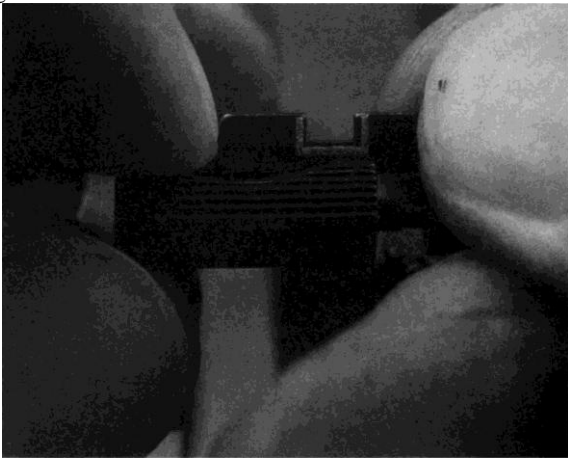
There are two methods of removing the old sight blade and replacing it. The factory method destroys and discards all the internal sight parts. Those parts cost money, and the method is wasteful when the only one broken is the blade. My method only requires a new blade.



Hold the lock nut with the pronged screwdriver while you unscrew with the regular screwdriver.



With the lock nut free, pull it out of the sight.

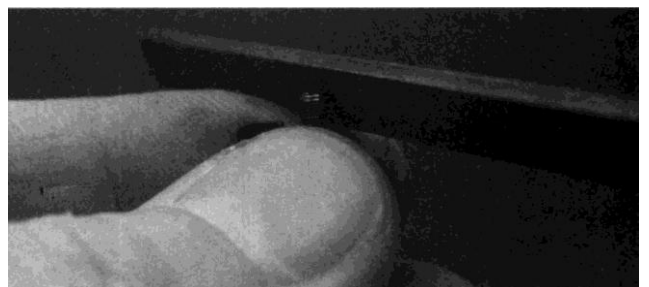


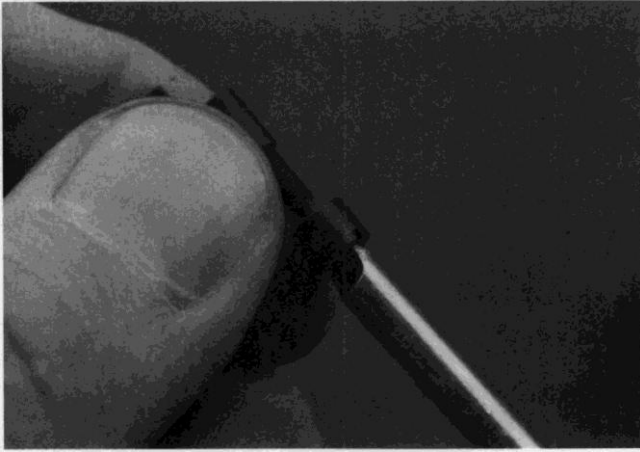
Keep your fingers over the plunger and spring as you slide the sight out.



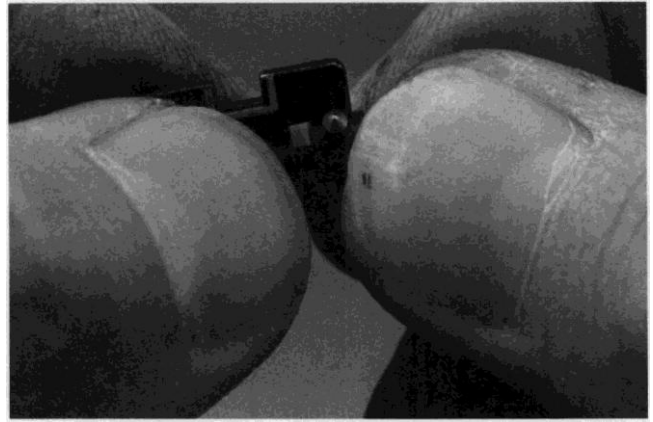
The rear sight assembly on a Smith & Wesson adjustable sight. The largest part is half an inch long. If you drop the spring or plunger, or allow them to leap to freedom, you will have a devil of a time finding them.

File the end of the shaft to remove the staked portion of threads. If you do not, you will not be able to either screw the blade on, or install the lock nut.

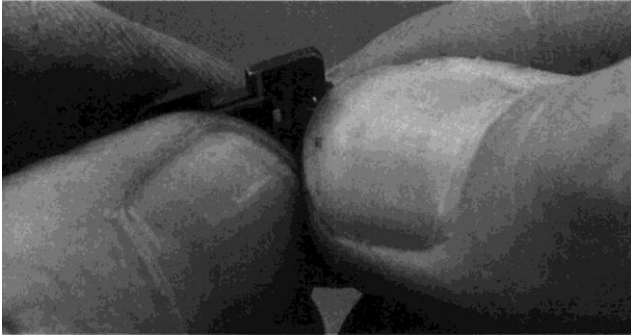




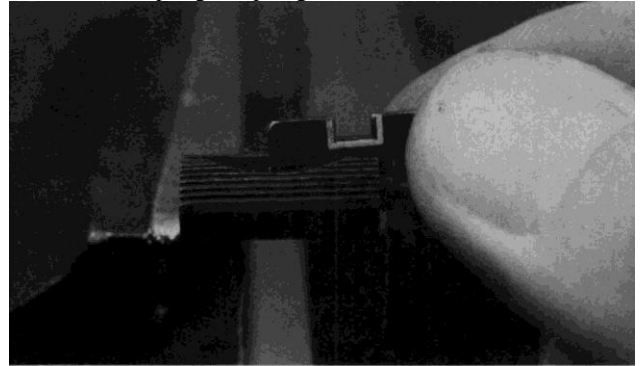
Screw the adjustment screw into the blade.



Place the spring and plunger into their hole in the shaft.



Depress the plunger with your thumbnail and rotate the nut until the plunger is held in place by the blade.



Slide the blade assembly into the housing.

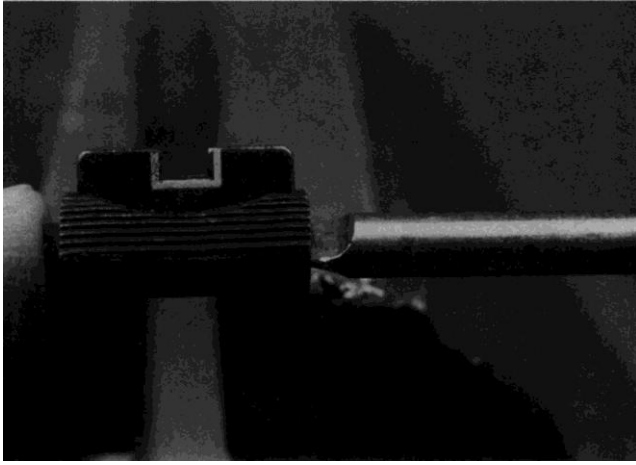
Place the modified screwdriver in the left side of the sight locking nut and the regular screwdriver in the adjustment slot on the right. Hold the modified screwdriver tight, and back the adjustment screw out. In three or four counterclockwise turns, you will have turned the locking nut free. Stop. Switch to the regular screwdriver to unscrew and remove the locking nut.

The adjustment screw has a detent spring and plunger, which cause the clicks you feel every time you adjust your sights. You must find the plunger. Rotate the adjustment screw. Look to the right of the blade. The plunger will come into view through the slot. When it does, stop. From the left side, push the adjustment screw out of the sight body, and use your fingertips to keep the plunger from escaping.

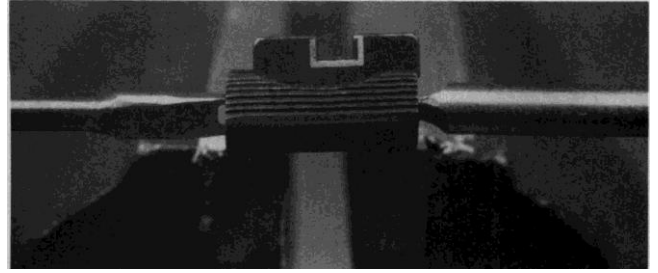
Pull the plunger and its spring out of the adjustment screw. Set them aside. To secure the screw to the locking nut, the factory stakes the end of the screw. You must remove these swollen threads. Bevel the end of the screw with your file, until the threads are gone. Now you can remove the adjustment screw from the broken blade. Screw the adjustment screw into the new blade. If you are using a white outline rear blade, the screw goes into the blade from the right.

Rotate the screw into the blade until the plunger hole can pass under the end of the blade. Insert the detent spring and plunger into the hole, and turn the screw so the blade holds the plunger in place. This way you will not have to compress the spring and plunger at the same time you insert the screw and blade into the sight body.

Insert the screw and blade and push them all the way to the left. Start the locking nut onto the end of the screw. Use the modified screwdriver to turn the locking nut down until it contacts the sight body, then back it out one-quarter turn.



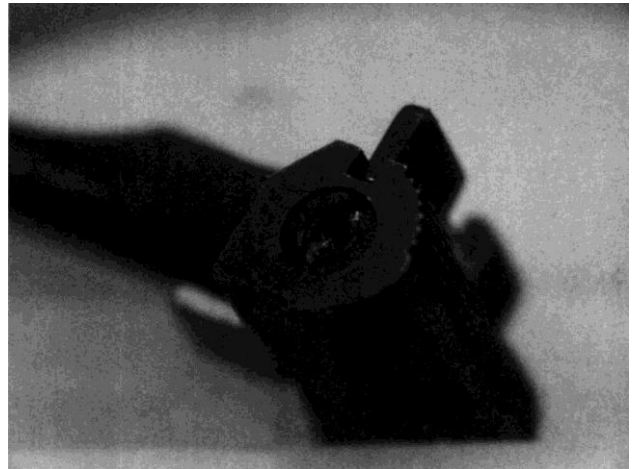
Press the lock nut against the shaft and turn the screw just enough to get the nut started on the threads.



Hold the adjustment lock nut in place while you turn the adjustment screw.



Use an eyeglass screwdriver or a tapered punch ground to a flat tip to stake the adjustment lock nut to the adjustment shaft.



The replaced sight, with the adjustment shaft re-staked.

Take the revolver out of the vise, and lay it on the bench on its right side. For support, put a copper, brass or plastic block under the adjustment screw. Don't use steel, as it may peen the sight slot. With the eyeglass screwdriver, stake the ends of the adjustment screw into the slots of the locking nut. Pick the revolver up and use the regular screwdriver to adjust the sights. Watch the locking nut. If the screw moves and the nut doesn't rotate with it, your staking was not strong enough. Line the slots up with the stake marks, and stake again. When the locking nut rotates with the adjustment screw, you are done.

The factory method? Turn the adjustment screw counterclockwise until the broken sight bottoms out on the left. Continue turning until you break the screw. Turn the locking nut to unscrew the screw shaft from the blade, and pull the broken screw out from the left. Use the now-loose blade to push the adjustment screwhead out of the sight body. Buy and assemble a new screw, blade, locking nut, spring and plunger into the sight body.

Chapter 7 - Recoil Reduction, or, Block That Kick!

“Ow, that hurt!” was probably the first thing Sir Isaac Newton said the moment after gravity made itself felt, and the moment before he figured out why. Being the proper English aristocrat that he doubtless was, when it came time to record his discovery he was quite a bit more formal. He even wrote it in Latin.

The part of Sir Isaac’s discovery which concerns us is the Second Law of Motion, “For every action, there is an opposite and equal reaction.” You have launched a bullet downrange. That’s your action. Now comes the equal and opposite reaction.

Recoil

It takes energy to launch the bullet, and you must pay the price. Not all of the equal and opposite reaction is felt as recoil, though. Part of it gets dissipated in heat. On a cold day at the range, you’re happy to feel that heat—it keeps your hands warm. Sometimes enough heat gets generated to cause shooting problems, but even when your gun is mighty hot, most of the reaction to launching the bullet is still happening elsewhere. It’s expressed as recoil, and your body must absorb it.

You will see recoil in two ways. Handguns respond differently in your hands because of differences in grip design. One type of recoil is the straight-back jolt that your hands, arms and shoulders feel. The 1911 comes straight back, as it was designed to. The other is the upwards rise of the muzzle, as the handgun rotates in your hand. The single-action rises, as it was designed to.

To reduce recoil, you can alter the handgun, the ammunition, or yourself.

First, consider altering yourself. Try building your upper body strength, and work on your hand strength. Making a stronger and more muscular you has no downside, and often reduces the discomfort of felt recoil.

Second, try shooting ammunition that has less power, and less recoil. Some competitions allow the use of soft-recoil ammunition. Others do not. If you gradually increase the power of the ammunition, you’ll find over time that you can comfortably handle a level of recoil that was objectionable before.

Finally, think about altering your handgun. There are only three ways to deal with recoil by altering the firearm, and all three have drawbacks:

(1) You can make the firearm heavier, and this will reduce felt recoil. It will also make the handgun less handy. Unlike a rifle, a shotgun, or even a baseball bat, the purpose of a handgun is to be ready. Right there, ready, convenient. Possibly right on you. If you make a handgun so heavy that recoil ceases to be a problem, you now may have a problem keeping your pants up. Small amounts of extra weight, in the right spots, can help. Simply adding mass to the handgun does not. We’ll look at those “right spots” later.

(2) With a pistol, though not a revolver, you can stretch out the time over which you experience the recoil, which, like adding weight, softens its impact. Also like adding weight, it doesn’t actually decrease the total energy kicked out at you. Just trading up to a heavier recoil spring does not help. The heavier spring will not soften felt recoil until the spring is so strong that it can actually cause malfunctions. You need an additional spring, not just a heavier one.



Kate Alexander dampens the recoil of her .45 with a compensator. This helps to improve her times at the Second Chance Bowling Pin Shoot.



Compensators have to vent gas to be effective. The more vents, the greater the recoil reduction, provided you have enough gas to feed all those ports. This nine-port comp from EGW is effective and loud.

(3) You can divert some of the muzzle gases to counteract the recoil. Diverting gases is the only method that actually decreases the total amount of force that you (the shooter) must absorb during recoil. By porting the barrel, installing a compensator, or both, you can redirect some of the gases created by the burning powder. In redirecting powder gases through the ports you run the risk of creating hazards and you definitely add to your cleaning problems. A barrel that's been ported needs special scrubbing around the ports. The hazards are not as easy to address.

Ported and comped handguns are loud. Efficiency and volume progress in lockstep; the more efficient a method is, the louder it is. If there are enough ports to effectively dampen recoil, or those ports are angled back towards the shooter, then the muzzle blast can be impressive, indeed. Some shooters find the extra volume of a comped or ported handgun to be objectionable, and no wonder. It can be difficult to find earmuffs that let you hear a start beep and still let you hear, when you are done shooting a comped gun.

At the Second Chance Bowling Pin shoot one year, I was on a three-man team with Bruce Britt and Bob Rosenberger. Bob was shooting next to me, and at 6-feet 7-inches tall and weighing 375 lbs, was not the least bit discomfited by his 12 gauge loaded with buckshot. My comped barrel, though, was something else. During one of the breaks, he turned to me. "That .45 of yours is really loud," he remarked. Bruce, way on the other side of Bob, leaned around him. "That was yours, Pat?" Bruce could hear my comped .45 on the other side of Bob and his shotgun. The comp was that loud!

Ports can cause other problems. If you are a fan of hip-shooting, you would be well-advised not to do so with a ported handgun. On some compensators the ports are angled slightly forwards or back, but most of the time the ports are angled up. Those upward ports divert the hot gases up, too. If you shoot from the hip with a ported or compensated handgun, your belt and shirt will be blasted by hot gases and powder particles. The shock wave can even roll up under the bottom edge of your shooting glasses, with very uncomfortable results.



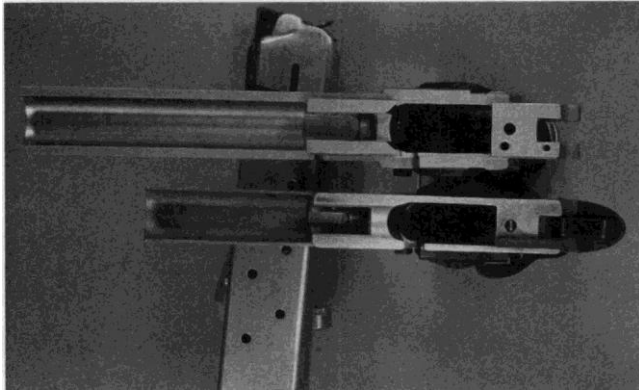
When the slide closes up. The Hybrid ports are not as noticeable as a compensator on the end of the barrel. They work, and for some competitions are considered a Stock, or un-modified pistol.



You can also add weight to your 1911 by installing a tungsten recoil spring plug, or retainer. The extra mass under the barrel slightly dampens muzzle flip on recoil.

Adding weight

There are a few "right spots" on your pistol where adding weight can make a difference in felt recoil. The grips are one of those spots. By using grips made of brass, pewter or steel, you can add weight without affecting the balance of the pistol. Some shooters find weighted grips uncomfortable; others can bolt them on and never notice them. Ajax Custom Grip makes grips out of pewter. For those with tastes that run to the flashy, they even offer the pewter grips gold-plated.



The STI frame has a longer, wider, heavier dust cover. This changes the balance for competition shooters.



Left to right, a Wilson heavy tungsten rod, a Cominalli tungsten rod with dual buffers on it, and a Harrrts mercury recoil reducer. All will cut down the felt recoil of your pistol.

Clamping weights to the handgun is common in Bull's eye and Police Practical Competition.

Weights are occasionally used in Bowling Pin shooting, but are much less common in IPSC. The targets in Bull's eye, PPC and Bowling pin shooting are close together or few in number. You have to engage targets over a much wider range in IPSC, and the heavier handgun is slower to swing.

Ron Power makes a barrel weight intended for PPC shooting that screws on to the bottom of a bull barrel. Some purpose-designed Bull's eye pistols, such as the High Standard Supermatic and Smith & Wesson M-52, can be ordered with frame-mounted weights. Wichita makes a slide-on barrel weight for revolvers that doubles as a compensator. It can only be installed on barrels that have a full-length underlug, such as the Python. The Wichita barrel weight, and forward-mounted weights for PPC and Bull's eye create a very nose-heavy pistol. That's fine for PPC and Bull's eye, and it can work on bowling pins. It's not good for IPSC shooting.

Some manufacturers of the 1911 and its variants are now offering modified frames. On the standard design, the recoil spring cover (curiously called the "dust cover") is scalloped up from the trigger guard. The new frames do not scallop the dust cover, but continue the frame forward with the same external dimensions it has at the front of the trigger guard. This extra weight dampens recoil and shifts the balance forward.

With a pistol you have more choices about adding weight. You don't have to settle for bolted-on chunks of metal. Consider using a weighted recoil spring guide rod. A heavy enough guide rod, being under the axis of the bore and not reciprocating with the slide, can cut muzzle rise. Out in front of the hands, it also adds a slightly muzzle-heavy feel to the pistol, but not as much as the frame weights create.

Starting out as simply a guide for the recoil spring, rods were first improved by Harrrts. They hollowed out the length and installed baffling ball bearings. Before sealing the rod, they partially filled it with liquid mercury. As the pistol begins to recoil, the mercury, acting in the manner of a dead-blow hammer, sloshes against the front of the tube and dampens some of the recoil. When using a Harrrts it pays to experiment with bullet weights and powder charges. Strike the right combination and the sloshing of the mercury will be timed exactly opposite the peak of the felt recoil. You will notice a significant decrease in muzzle rise.

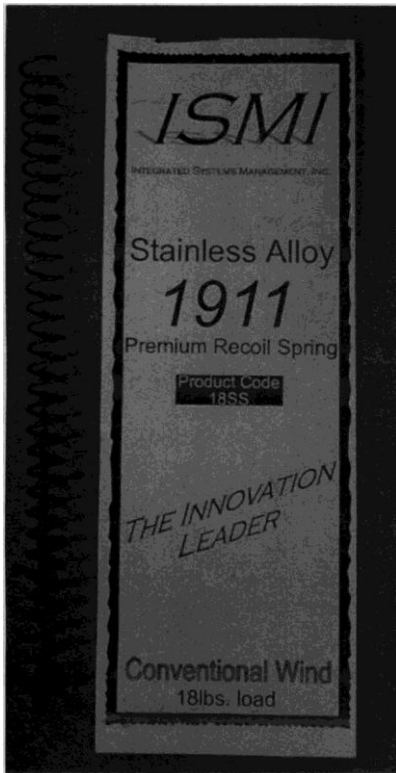
Mercury is toxic, causing brain damage and mental illness. The Harrrts rod is a sealed unit for a reason, and you must not cut, grind or heat it. The character of the Mad Hatter in Alice in Wonderland depicted a real situation in England in the 19th Century. The compounds then used to manufacture hats contained mercury, and hatters quite commonly went crazy. Keep the Harrrts sealed, and you will have no such problem.

Tungsten rods offer an improvement over the Harrrts. Tungsten is a solid, dense metal not nearly as toxic as mercury. Denser even than lead, tungsten is 98.5% as dense as gold, harder than either gold or lead, and a lot cheaper than gold. The tungsten rods come in two weights. The three-ounce rod fits into a standard slide without modifications. If you want to go to the five-ounce rod, you have to alter your slide and use a larger diameter recoil spring.

Extending the time

How recoil feels depends on how long you experience it. The shorter the time, the sharper the recoil. To lengthen the time, and soften the impact of recoil, first check your recoil spring.

Standard recoil springs are made of music wire. Manufactured by steel mills and shipped on large drums to the spring maker, the wire must there be wound to the proper diameter and coils per inch, cut to length and turned into springs. Winding puts a lot of stress on the wire, creating hundreds or even thousands of micro-fractures, and these fractures greatly shorten the useful life of the spring. The springs cannot be further treated after forming without losing their temper and shape.



Integrated Systems management makes recoil springs that do not seem to shorten with use. Preliminary testing has convinced me to switch.



The Kimber at the range, ready to consume 1400 rounds of ammunition, testing the springs. The pistol gobbled all that ammo without a problem.



This Kimber pistol was used as the test-bed to determine if the ISM springs really were resistant to taking a set after firing.

With the wear of many rounds, the already delicate recoil spring loses strength and shortens. Called “taking a set,” this shortened and weakened spring can accelerate wear on your locking lugs. It also lets the slide slam into the frame harder at the end of its stroke than it did when the spring was new. You feel more recoil. Take a brand new spring and measure its uncompressed length. Record this measurement, called the “free length.” It is not unusual for a new spring to lose three quarters of an inch after only 500 rounds of heavily-loaded ammunition. I replace a spring when it has lost 7/8-inch of its free length.

Because the spring can shorten so quickly, serious competitors record the free length of their springs each time they clean the pistol, and replace the old spring with a new one when it has reached the end of its useful life. The 7/8-inch measure might not work for you, but if you keep track of your rounds, and record your free length, you can get a feel for when your springs need replacing. A good spring, with a normal load, may last 2000 to 4000 rounds, even more. If you use heavy loads or cheap springs, a spring may have lost half of its useful life in 500 rounds.

Integrated Systems Management has begun manufacturing springs from a chrome-silicon alloy. Because the alloy can be shot-peened and stress relieved after it is shaped, the new springs show great promise. ISM has tested them through 100,000 cycles, and found they do not lose more than .350-inch of free length. And, they are fully warranted for 12 months.

I tested ISM springs against traditional springs by Wolff. Since springs will take a set the very first time you install them, I measured both types of springs right out of the package.

Using a Kimber project pistol with the factory guide rod, I started with the ISM spring. After every 100 rounds of IPSC/USPSA .45 ACP practice ammunition I checked the free length of the spring, stopping when I had put 700 rounds through the pistol. Then I fired the same pistol with the Wolff spring, again stopping and measuring after every 100 rounds.

I used a 200 grain Semi-wadcutter bullet from Northeast Bullets of Maine, loaded over 5-6 grains of Winchester 231. Out of the Kimber, the load clocked 826-feet per second. This is my practice load for IPSC/USPSA competition, with slightly less power than the competition load.

The test showed the superiority of the new Chrome Silicon springs for useful spring life.

If you are interested in taking some of the slide slap out of recoil, a dual recoil spring system is the best way to diminish the feel of the slide bottoming out against the frame. A dual recoil spring system looks like a guide rod with two springs on it. The second, or rear, spring is attached, and is a much stiffer spring than the first, or main recoil spring. The main spring holds the slide closed and is the spring initially compressed as the slide begins to move. Near the end of the slide cycle, the recoil spring retainer strikes the second spring. This stiff spring buffers the impact of the slide against the frame, decreasing the slap the slide delivers to the frame.

The tricky part of designing a dual recoil spring system lies in reducing the jolt without restricting the slide's travel. If the slide does not travel its full length, you can have feeding and reliability problems. The slide may even fail to lock open when the magazine is empty.

Bar-Sto, famous for their barrels, made an early version of a dual spring system without the guide rod. They started with a modified recoil spring guide containing a spring and a plunger that stuck out in front. As the slide came to the end of its travel, the recoil spring retainer would bottom out against the plunger, slowing the slide. Though the system worked, Bar-Sto found they had to drop it from production. They just didn't have enough hours in the day to make both barrels and buffers.

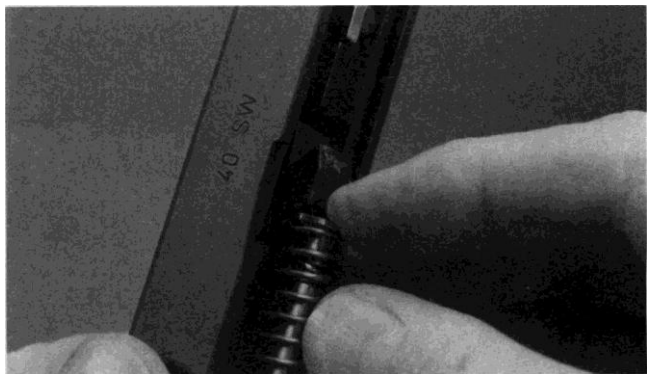
Chandler Arms and Sprinco both make dual recoil spring systems. Available for 1911, Glock, Beretta, and more coming all the time, they significantly reduce the recoil jolt of the slide bottoming out in the frame. To use one simply slide your chosen standard recoil spring over the guide rod assembly and assemble the pistol.



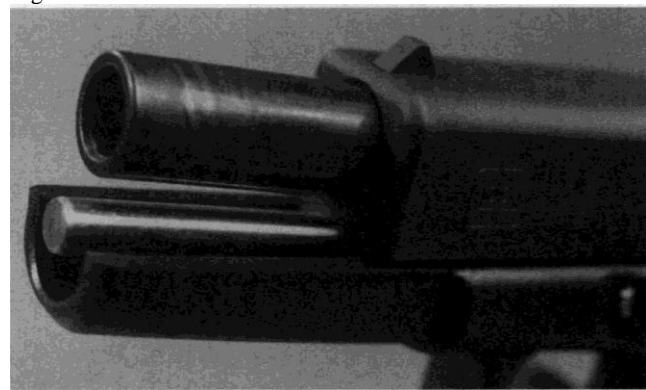
Both Chandler Arms and Sprinco make dual-spring recoil guide rods, and they make them for a number of different handguns.



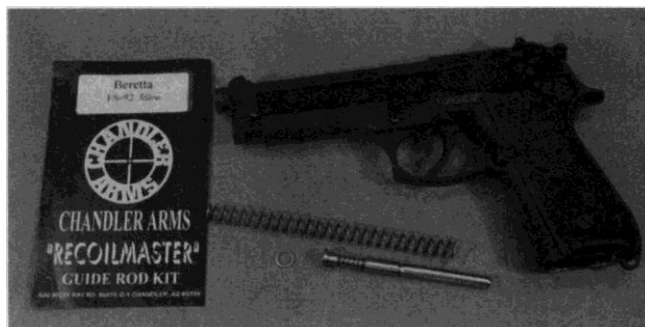
Place the front of the recoil spring against the slide and compress the spring.



Catch the rear of the Sprinco rod in the barrel seat, and you are ready to go.



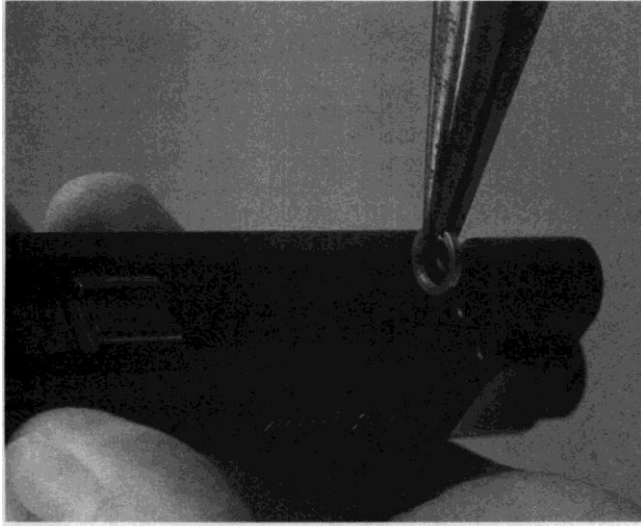
Here is the Glock M-22 with the installed Sprinco dual-spring guide rod.



The Chandler Arms guide rod kit can reduce the felt recoil of hot loads in your Beretta.



1. Grab the old recoil spring guide rod and remove it.



2. Place the included washer in the front of the recoil spring tunnel.



4. Compress the spring and slide the Recoil Master into the barrel recess.



3. Place the front of the recoil spring against the slide washer and then press the rod towards the muzzle, compressing the spring.



5. With the slide locked back, the Chandler Arms Recoilmaster is apparent only as a bright metal rod.

Recoil buffers perform the same function as dual spring recoil systems, but sacrifice themselves in the process of buffering slide slap. In a few thousand rounds, you may find that your shock buffer is almost too beaten up to perform its job. I have seen shock buffers so abused that they actually had pieces chewed off by the slide. Those pieces floated around in the dust cover until the next cleaning.

Chandler Arms has recently come out with a hollow Tungsten rod filled with mercury that uses both a dual recoil spring system and shock buffers. I'm sure other companies are working on more improvements, too. Does the ingenuity of man know no bounds?

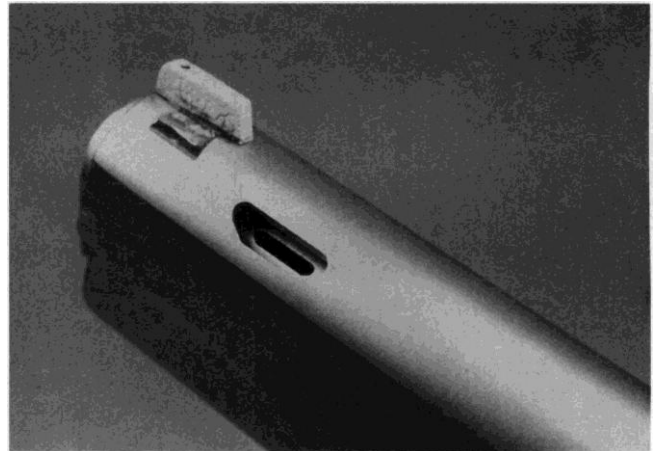
Compensation

The ports on the compensator divert the muzzle gases upwards, damping the muzzle rise under recoil. The gases striking the internal baffles of the compensator pull forward on the barrel, decreasing the rearward component of recoil. The more efficient a compensator is, the more your barrel gets pushed forward and down by diverted muzzle gases. As a result, most comped barrels require a lighter recoil spring. That's easy enough. There's just one problem. Most compensators also require a new barrel. And porting a new barrel often means a machine shop. A lot of porting and comp work is completely beyond the scope of the home workshop.

The usual method of adding a compensator begins with a longer-than-normal replacement barrel, threaded at the muzzle end. The barrel is fitted to the pistol, and the compensator is fitted to the barrel-slide assembly. One particularly efficient porting-compensator combination is the Scheumann Hybri-Comp. The barrel has a raised spine, with rocket ports through the spine to the bore. For the spine to clear the slide, the slide must have a slot milled through it from the muzzle back almost to the locking lugs. This milling is best done with a large, powerful mill. A compensator is threaded onto the muzzle of the barrel.



Mag-na-port can put ports in your barrel with Electrical Discharge Machining. It does not alter the finish, harm accuracy or decrease velocity. Well, it doesn't if you only get one or two sets. The seven slots in this barrel have decreased measured velocity about 2 percent. 20 fps off of a load that delivers 1,000? No problem.



Mag-na-port also uses the EDM process to put ports on pistols, right through the slide. The hole in the slide is larger to allow the gases to blow out of the pistol.

Mag-na-port

The simplest for the shooter, the most elegant, and the least intrusive method of porting, the Mag-na-port process has been available for over 20 years. Larry Kelly came up with the idea while cutting metal for NASA, making Mag-na-port a true outgrowth of rocket science. Using Electrical Discharge Machining, MNP cuts slots in the barrel of your handgun. Larry Kelly is now retired, and spends his time hunting, fishing, and promoting the sport of Handgun Hunting. The top slot at Mag-na-port is ably filled by his son, Ken.

The Mag-na-port process works on pistols or revolvers, but it is particularly cost-effective for revolvers. While you can install a compensated barrel on a pistol, and with a little effort, swap the barrels back and forth, you cannot easily do this on a revolver. Unless you're up for a lot of aggravation, you cannot have a Stock and an Open revolver in one frame. What you can have, at a quarter the cost of a new compensated barrel for a pistol, is a Mag-na-ported revolver. For the cost of two or even three sets of slots in your revolver, you will still have money left for practice ammo. For some years now I have been shooting a Smith & Wesson 25-2 at Second Chance. I use this .45ACP revolver for the 8-pin event. It has three sets of ports, and even with heavy .45 pin loads the muzzle hardly comes up at all. I am thinking of adding more ports.

To Mag-na-port a pistol, the port has to go through both the barrel and slide. (The Beretta and Taurus are the exceptions.) To keep the gases from getting trapped between the slide and barrel, and to reduce powder residue, Mag-na-port cuts the slide slot much larger than the barrel slot. Despite this, a Mag-na-ported pistol still must be cleaned more frequently than a pistol not ported. A Mag-na-ported revolver does not require more frequent cleaning.

How does the process work? The EDM machine is basically a large spark plug, with your barrel in the gap. By placing a precisely-shaped carbon electrode next to the barrel, and pumping a huge electrical charge across that gap, the machine creates a spark that erodes the metal. Since the spark can only jump a very small gap, the outline of the electrode is faithfully re-created in the barrel. Mag-na-porting won't disturb or discolor bluing or plating. It won't cause burrs. It doesn't stress the barrel wall. So long as your barrel is made of, plated with, or coated by, an electrical conductor, Mag-na-port can port it.

I once sent them a comped barrel, with instructions to EDM slots behind the ports. I neglected to tell Ken that the comp was held on with the top grade of Loctite. When the electrode reached the Loctite, the EDM cutting stopped. Before he could continue, Ken had to pull the barrel off the machine and scrape enough of the Loctite off the threads to make an electrical contact.

Porting and velocity

The question often comes up. Does porting reduce velocity? With the exception of the Scheumann Hybrid, no. The fraction of gases diverted by the ports cut by Mag-na-port, or by factory ports, is a tiny portion of the total gases available to push the bullet. And, since the ports are near the muzzle, the gases have already done most of their work anyway.

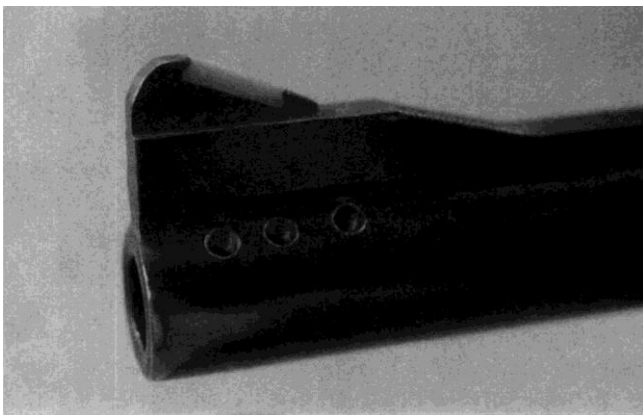
The compensator, screwed onto the end of the barrel, scavenges gas after the bullet has left the muzzle. If anything, a compensated barrel on your pistol usually boosts the muzzle velocity. To screw on the compensator body you have to put a longer barrel on your pistol. In addition, this new barrel is usually a match barrel, smoother inside and with less friction to slow down the bullet.

The rocket nozzles of the barrel in the Scheumann Hybrid are large, and the first one is much closer to the chamber than any other porting system. As a result, the ports bleed off large amounts of gas and reduce velocity. They also push the barrel down so hard, and so soon in the firing cycle, that the sights have to be adjusted to compensate for the ports.

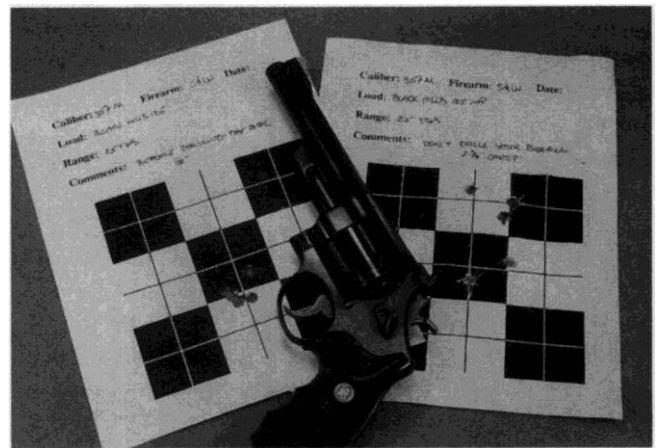
Competitors who shoot a Scheumann Hybri-ported barrel commonly load their ammunition with greater amounts of powder, so they can both feed the ports and maintain velocity. They are also extremely careful not to mix this ammunition with other ammunition in the same caliber. The ammunition loaded for the Hybri-ported pistol, if fired in an un-ported pistol, may exceed safe pressure levels.



Available from Caspian Arms, the Hybrid compensator ports are very effective in reducing felt recoil and muzzle flip. They are also loud and require a modified slide.



Some people think that drilling their own holes for recoil reduction is a cheap alternative. Actually, it ends up being an expensive one, after you replace the barrel you have ruined.



This Smith & Wesson revolver had its barrel drilled for recoil reduction. Before, it shot well but not spectacular groups of 7/8ths of an inch. After, the groups rarely were smaller than three inches!

Projects:

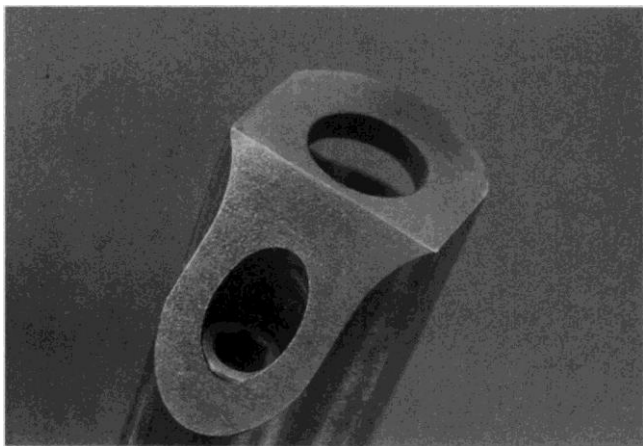
A project NOT to do: your own porting

There is always someone at the gun club who feels that port design is over-rated (Wrong!) and that the job can be done just as well at home. (Wrong again!)

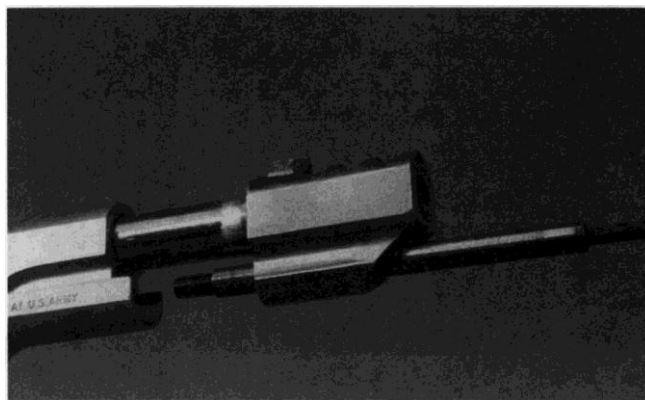
Remember the practice plate in Chapter 6, where we drilled and then tapped? The top of the hole, where the drill entered, did not have a lip after you drilled it, but the bottom did. Unless you can figure out a way to drill your hole from the inside of the barrel, you will kick this lip up inside, where it can harm accuracy.

Using an S&W revolver with a "tired" barrel, I tested a home-porting process. Using a Ransom Rest I checked the barrel for accuracy before and after drilling "ports."

To guarantee ports cut as cleanly as possible, I purchased a brand-new, razor-sharp carbide drill and used a rigid setup on the drill press. After drilling, I scrubbed the bore with a stainless steel brush, in hopes of knocking off any burrs left behind. The results were dismal. Before porting the “tired” barrel still would shoot 7/8-inch groups at 25-yards from the Ransom rest. After the porting, the groups averaged 3 inches. Why trade group size for recoil reduction when you don’t have to? Revolvers that have been Mag-na-ported show no decrease in accuracy whatsoever.



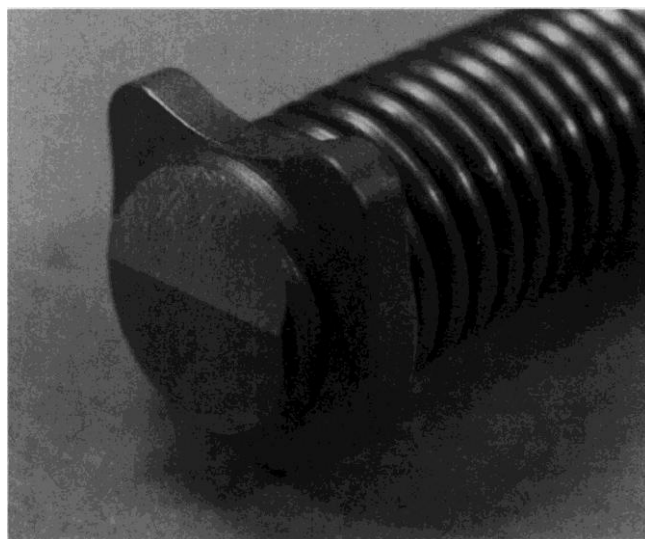
Two-piece recoil spring guide rods commonly have a hex-end for an alien wrench. This allows disassembly.



Once the two-piece rod is unscrewed, pull the front half out of the pistol.



With the slide locked back, unscrew the guide rod.



The back end of this Wilson tungsten recoil rod has been beveled. If your recoil spring guide rod is not beveled this way, file it.

Fitting the guide rod to a 1911

A new guide rod (ordinary stainless steel or 3-ounce tungsten) will come with its own recoil spring retainer. It may also come with a new recoil spring. Take your unloaded pistol and remove the slide. Remove the recoil spring, recoil spring retainer, bushing and barrel. If the new guide rod did not come with a spring, check your old recoil spring to make sure it fits the rod. Try inserting the new recoil spring retainer in the recoil spring tunnel, and make sure it fits the slide.

Is your rod a one-piece or a two-piece rod? Two-piece rods are easier to install. For the two-piece rod, reassemble the pistol but use only the rear section of the guide rod. Once the pistol is assembled, lock the slide back, stick the front half of the guide rod through the hole in the spring retainer, and screw it tight. Now slowly cycle the slide, and see if the slide binds along its travel. It should not. If it does, the top of the guide rod head (the horseshoe shaped part) is too tall. It is preventing the barrel from coming down fully during unlocking.

Unscrew the front half of the rod, and disassemble the pistol. File the top curve of the guide rod head with a half-round file. De-burr the edges of the filed portion, and re-install and check again.

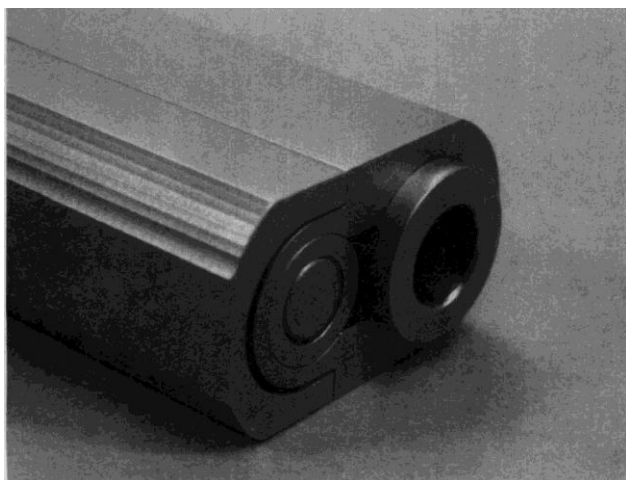
Look at the back end of the guide rod which sticks out past the rod head. This end fits in the recoil spring recess in the frame tunnel, keeping the recoil spring plug from shifting. It does the same for the guide rod. If you see two marks on the top of this end, the lower lugs of the barrel are rubbing against the new rod. When the recoil spring guide was a short plug, the barrel could push on it with no problem. There was plenty of room for the plug to move. With a solid guide rod there is no place for the rod to go when pushed. You need to remove any interference. File the back end on an angle, just enough to clear the lower lugs of the barrel.

To reassemble the 1911 using a one-piece guide rod, install the barrel and bushing in the slide. Be sure the bushing is turned all the way in, for proper recoil spring retainer installation. Flip the barrel link back, away from the muzzle. Slide the guide rod from the rear into place in the slide.

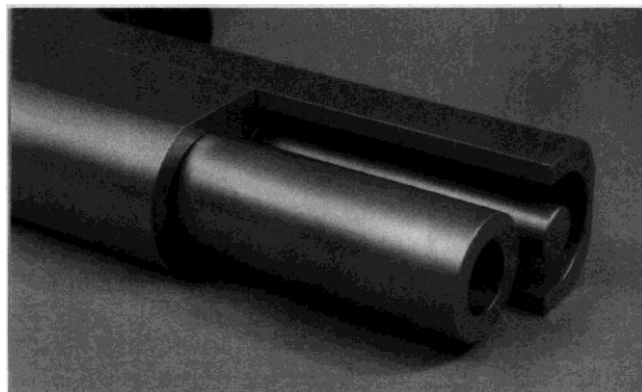
Clamp the back of the slide in a padded vise. From the muzzle end, push the recoil spring down over the guide rod and through the slide. Put the recoil spring retainer over the end of the spring, and compress the spring down into the slide. Holding the spring and retainer down, turn the bushing to lock them in place.

Now slide the slide onto the frame, and do your function checks.

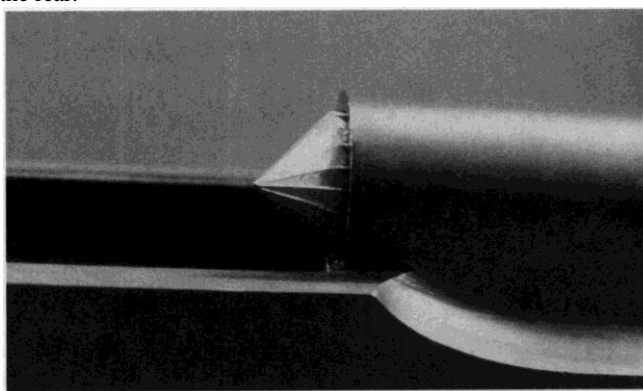
Some 1911 pistols dispense with the barrel bushing. While the standard retainer is held in by the barrel bushing, on pistols with no bushing the barrel tapers out towards the muzzle, filling the slide at the front. To keep the recoil spring retainer in the slide of pistols lacking a barrel bushing, you will have to modify the slide. Install the recoil spring retainer from the rear. A shoulder on the retainer will keep it from shooting out of the front of the slide. To keep proper slide/frame clearance at the full rearward travel of the slide, the rear of the slide tunnel where the retainer sits, must be removed by the thickness of the retainer's shoulder.



Some pistols are designed without barrel bushings. This STI pistol uses a tapered barrel that fills the slide. The recoil spring retainer is a reverse-plug. It must be removed from the rear.



You can see the thickness of the barrel, and how it fills the slide.



The EGW reverse plug reamer removes the internal shoulder in the recoil spring plug tunnel.

The guide rod will have an assembly/disassembly hole drilled through it. To assemble a guide rod with a "reverse plug," place the spring on the guide rod. Take the reverse plug and slide it on the spring. Compress the spring with the plug. When you get past the assembly/disassembly hole, place a capture pin in the hole and lock the plug back.

Now install the guide rod assembly in the slide from the rear. Make sure the edges of the retainer shoulder line up with the edges of the cut in the slide, and that the guide rod is turned to properly fit the bottom of the barrel. Put the slide on the frame. Run the slide back just far enough to install the slide stop lever. Lock the slide open. Pull the capture pin out of the guide rod. The slide should function normally. If not, repeat the fitting procedure described above.

To disassemble a 1911 with a coned barrel and one-piece guide rod, lock the slide back, place the capture pin in the hole, and then ease the slide forward until the retainer rests against the pin, restraining the spring. Take the slide off the frame and remove the guide rod assembly from the rear of the slide.

Fitting the five-ounce Tungsten guide rod

The heavy rod is larger in diameter than the standard rod, and requires a special recoil spring to fit over it. The rod/spring assembly uses all of the space in the slide tunnel leaving none for the recoil spring retainer. To keep the spring in place, the retainer is reduced to a shouldered washer, and must be held in with a barrel bushing.

The recoil spring tunnel on the slide has a shoulder, or ledge, in it. This shoulder prevents the standard retainer from falling out the rear of the slide during disassembly. It must be removed to fit the over-sized rod.

There are several ways to remove the shoulder. The easiest is to clamp the slide vertically in a drill press or mill. With a 1/2-inch drill inserted from the front of the slide, drill the shoulder off. Evolution Gun Works makes a carbide-tipped reamer for this, and it cuts like a dream. Do not attempt this modification with a hand-held variable speed drill. The shoulder is not a complete ring around the inside of the tunnel. There is a gap. The drill will try to squirm out through this opening. You can damage the slide and even hurt yourself.

If you don't have a drill press or mill, you can use your Dremel tool to remove the shoulder. Use a 1/2-inch ball grinder, and reaching in from behind, grind the shoulder off. Use the guide rod as a gauge to tell when you have removed all of the shoulder. If, after grinding, you can't easily insert the guide rod assembly from the front of the slide and push it past where the shoulder was, you have overlooked some part of the shoulder.

With the shoulder gone, clean the slide to remove any stray metal particles. Install the barrel and bushing. Leave the bushing in the down, or locking, position. Insert the guide rod assembly. Put the slide on the frame and run the slide back far enough to install the slide stop. Lock the slide back and remove the capture pin. Check function to see if the guide rod is binding on the barrel, and fit if necessary.

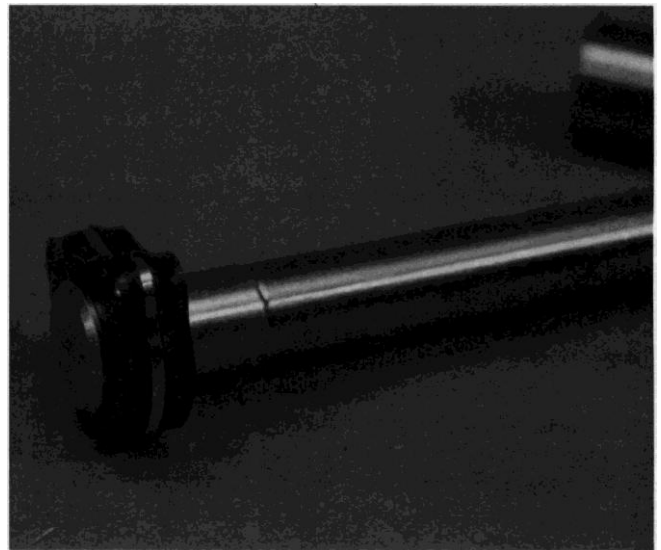
Fitting dual-spring recoil systems

The fitting of a dual-recoil spring system is the same as fitting a one-piece guide rod, with one additional step: you must make sure that the fully-compressed rear spring is still short enough to allow the slide to cycle back to the hold-open notch. If, in full compression, the spring is too long, the pistol will never lock open when it is empty.

To correct this problem, you must decrease the length of the spring when fully compressed, either by clipping coils from the spring or using a spring with thinner wire. If you have this problem, call the manufacturer of the dual spring unit. You may find they can solve your problem over the phone.



You can get recoil buffers in different thicknesses. The top three are .090, .125 and .200-inches thick. The bottom one is for the Beretta M-92.



The Cominolli rod with its dual buffers. The impact of the slide is soaked up by the plastic buffers without either the rod head or the frame getting peened.

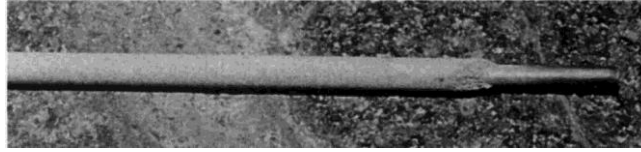
Shock buffers

These little plastic wafers, known by various names (Shok buff, buffs, pads, little plastic doohickeys) were originally intended to decrease wear on the slide and frame. A properly maintained and sprung 1911 has a service life so great, I'm not sure how much they actually help in their original role.

But they do cut down on the jarring part of the recoil where the slide bottoms out against the frame. To use a standard buffer, slide it over the recoil spring guide rod or standard guide plug. Slide the spring over the rod, capturing the buffer in place.

The Cominolli system uses two buffers, one in front of and another behind the recoil spring guide rod head. The two buffers act as shock absorbers between the guide rod head and slide, and the guide rod head and frame. As useful as two buffers are, you cannot simply stuff a second buffer in behind your standard guide rod. A standard buffer will not stay in place. The guide rod will stick out the front. You must use the Cominolli system, with its slightly thinner rear buffer, and smaller diameter hole through the buffer. The Cominolli rear buffers are also slotted, allowing the buffer hole to snap over the stud on the back of the rod.

Chapter 8 - Welding and Metal Joining



Coated welding rod. The coating creates a layer of gas around the weld, preventing atmospheric oxygen from reaching the bead and contaminating it.

When you want to join two metal parts permanently, unless they are pieces of your furnace, duct tape simply will not do. Granted, duct tape has many uses. Pistolsmithing is not one of them. For handguns, we need something with a lot more style and strength.

Joining metal means welding or soldering. There are two differences between these processes. Welding will always require a higher temperature than soldering. Also the “glue,” or intervening metal between the two parts being welded, will be the same as the two parts. In soldering this “glue” will always be a different metal.

The metals used in gunsmithing work just like any other solid, only at a higher heat. A solid is a material that does not melt until heated above room temperature. Think of liquid water and solid ice, and you can understand steel. Water is a solid — ice — below 32°F, and boils off to vapor at 212°F. Soldering and welding metals requires high temperatures. Depending on the alloy tested, solid steel melts to liquid somewhere between 2450 to 2780 degrees. The boiling point? Over 6000 degrees Fahrenheit!

As metals get hotter they change their color. This change is especially marked with steel and allows you to gauge the temperature simply by looking. Looking without goggles works fine for soldering. At the hottest welding temperatures, though, the light given off by the steel, the torch, or the electric spark will damage your vision. Buy and use industrial-rated goggles before you begin, or begin watching, welding. Sunglasses will not do.

In a welded joint, you melt the edges of the two parts to be joined and feed in additional metal of a similar composition from a filler rod. The two parts and the added metal become one part, with no clear border between them. The added metal fills gaps between the parts, and replaces metal that is lost from the intense heat. Excess filler puddles on the surface, and is called the “bead.” You grind, file and polish the bead, creating a smooth surface at the joint. Without the bead, refinishing is much more difficult.

There are a number of ways to weld. The oldest, forge welding, is what the blacksmith does. Two pieces of metal are heated. Instead of melting the metal to create a joint, the blacksmith hammers the hot pieces together. While hammering gives a blacksmith strong arms and hands, useful in reducing the shock of felt recoil, there is little else about forge welding that is useful for handguns.

The first improvement in welding came near the end of the 19th Century. Called gas, or oxyacetylene, welding, this improved process mixes two gases in a welding torch nozzle and ignites them. The resultant (and very hot) flame is used to melt the parts being joined as well as the filler stick.

Now we have electric welding, where a large electrical charge is used to heat the parts and the filler stick. Machine shops use electric welding because it is cheap and precise.

In every type of welding, the creation of so much heat in the presence of atmospheric oxygen creates a large amount of burnt metal, “scale.” Scale is bad for the weld, and can weaken it. To reduce scale, welders use coated filler rod. When the coating (“flux”) melts, it generates a gas that floats to the surface of the weld, insulating it from atmospheric oxygen. Once the metal cools, the resultant “slag” can be cleaned off. Another way to reduce scale is to bathe the area welded in an inert gas, shielding the weld from the outside air. This is TIG or MIG welding.

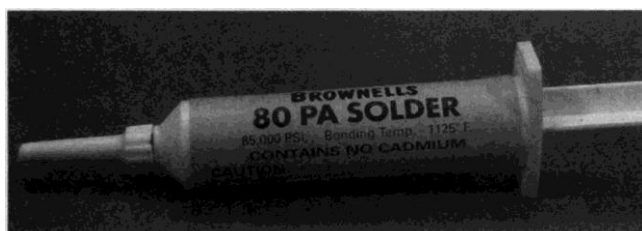
Welding requires temperatures well above the melting points of the metals involved, or the metals will not flow together and create a strong joint. While the welded area must be heated past the melting point, it cannot be made so hot as to burn up, or vaporize, the metal. The amount of heat you can pump into a small part without vaporizing it is very limited. The amount needed to weld it is only a bit less than that. You can burn up a number of expensive handgun parts before you learn the exact amount of heat needed. Good welding comes through experience.

A welded joint, properly done, is as strong as the metal itself. A bad weld, with voids and slag in the bond, is not. A weld that does not penetrate into the parts, but joins only at the surface, will be weak. The heat from any weld can also affect the heat-treatment of the parts joined. If you are welding near a critical area, such as the locking lugs of a slide, you must instruct the welder to use a “heat sink” to protect the temper in that area. The heat sink is a block of metal that draws off heat before it can reach an important area.

In a soldered joint, you place the two parts together, apply a protective layer of flux (not the same flux used in welding) and heat the parts enough to melt the solder that will join them. You don’t heat the solder. After cooling, the parts are a single piece, but the joint, being made of a different metal, is visible. The metals of the two parts are not mingled.

Solders are referred to by their metal compositions. The softest, lead solder, is commonly referred to as “soft solder,” and usually has a melting point around 600°. The low working temperature makes soft solder very useful for electronics and electrical applications. The very low melting point, however, comes at a price. Low-temp soft solder has a bond strength of only 4,000 pounds per square inch. While 4,000 psi will work for a long gun, handguns require much higher bond strength.

When considering the use of a soft solder alloy you must keep in mind that soft solder alloys, while easy to work with, have a very poor record of surviving the caustic solutions used for bluing. Old double-barreled shotguns have been known to come out of the bluing tanks in pieces, as the soft solder used to hold the ribs to the barrels commonly gets dissolved by the bluing salts.



Brownells makes a high-temp silver solder that is in paste form with its flux mixed in. Very convenient in use, it is a high-strength solder.



Three different welding guns, MIG, heli-arc and stick. Each requires a different technique to use, and delivers different results.

Introducing silver into solder mixtures increases their strength and makes them very useful for handgun purposes. Called, not surprisingly, silver solder, the hottest mixtures melt at 1125° and have a bond strength of 85,000 psi. Use a silver solder for anything that will be blued or plated.

Firearm manufacturers fasten parts together with a slightly different alloy, one that contains copper or bronze instead of silver. The process is called brazing. The reason is cost. When you are attaching gas cylinders to thousands of shotgun barrels a year, the cost difference between a solder that contains copper and one that contains silver can be significant.

The equipment for welding is expensive, and you must weld on a regular basis to keep your touch. If you are considering home welding, the minimum equipment you’ll need is a set of oxygen and acetylene tanks, hoses, nozzles, heavy gloves, an apron, and a welder’s mask.

Expect to wear long sleeves and long pants for welding regardless of the weather — the temperature of the torch and the steel is so hot, and the light given off is so bright that you can get “sunburn” on exposed skin. The frequencies of the light given off by the arc on electrical welding equipment are in the ultraviolet range. Even though it doesn’t come from the sun, what you end up with is real sunburn, only much worse. Like the light from an eclipse, the light generated by welding can cause blindness. That’s why, even on the hottest days of the year, welders wear long sleeved shirts, gloves, aprons and a mask.

To hold the parts being welded, you need a heavy gauge steel table (you can’t weld on wood) and a machinist’s vise with copper jaws. The copper provides both a heat sink and a non-adhering surface. If a bit of bead flows off the part onto the copper, it will not stick. Use a steel-jawed vise, and you’ll end up with your part welded to your vise.

Not only is this a lot of expensive equipment, it also must be properly handled and serviced. Some precautions, like securely fastening the tanks to an upright so they don’t fall, should be obvious. If a tank is left unsecured, and falls, it can break off its valve and regulator and turn-quite literally-into a rocket. That’s no exaggeration. Oxygen is bottled at 2,200 psi. If a 200 pound tank falls and breaks off its valve, that 2,200 lbs of thrust will propel the 200-pounds of tank right through a brick wall, a car, or you.

You must be sure your tanks do not leak, and are not exposed to any unintended sparks or flames. Acetylene is highly flammable. A slight leak can create a cloud of vapor. Light a match, and you can ignite the cloud. The results can be fatal.

Other precautions are not so obvious. You must never use any kind of oil or grease on the threads of the oxygen tank. The oxygen is so pure, and its pressure in the tank is so high, that any grease the oxygen contacts can spontaneously burn. This is not merely inconvenient, it is catastrophic.



A typical welding shop has bare walls, high ceilings and lots of ventilation. It is cold in the winter and hot in the summer. You can't prevent this without lots of insulation, which increases the fire risk.

Surgical Technology (SUR)					
<i>The following courses meet for 15 weeks</i>					
30990	SUR	150	01	Surg Tech III Ther	
30991	SUR	155	01	Surg Tech III Prac	
Welding and Fabrication (WAF)					
<i>The following courses meet for 15 weeks</i>					
31016	WAF	106	01	BPR for Welders	
31034	WAF	210	01	Weld Metallurgy	
<i>The following courses meet for the first 7 1/2 weeks</i>					
30992	WAF	100	A1	Fund Of Welding	
30993	WAF	100	A2	Fund Of Welding	
30994	WAF	100	A3	Fund Of Welding	
30995	WAF	100	A4	Fund Of Welding	
30996	WAF	101	A1	Acetylene Welding	
30997	WAF	101	A2	Acetylene Welding	
30998	WAF	101	A3	Acetylene Welding	
30999	WAF	101	A4	Acetylene Welding	
31000	WAF	102	A1	Arc Welding	
31001	WAF	102	A2	Arc Welding	
31002	WAF	102	A3	Arc Welding	
31003	WAF	102	A4	Arc Welding	
31004	WAF	103	A1	Heli-arc Welding	
31005	WAF	103	A2	Heli-arc Welding	
31006	WAF	103	A3	Heli-arc Welding	
34				Shaded classes begin at 5:30 p.m. c	

Your local community college may have classes on welding. If you are really curious about trying to weld, learn in a classroom rather than through trial — and — error. A mistake with a welding torch can cause serious injury.

Welding is best done in a building with a bare concrete floor, block or sheet metal walls, and an un-insulated high ceiling. Besides the great heat generated, welding throws off a large number of sparks. These sparks must not contact anything flammable or they will start a fire. With the oxygen and acetylene tanks nearby, you might soon have an explosion.

Welding is a job that is hot in the summer and cold in the winter. You must invest a great deal of money and time in order to do it well. You must have a dedicated space. You must be very safety conscious. And you must practice to be any good at it.

I hope I have persuaded you away from personally welding your handguns. If you are still curious, sign up with the local community college for courses on welding. There, you can find out if you have the knack for it without spending a small fortune on the equipment. You will also get instruction from people who do it for a living. You will find out quickly if you have the welding touch.

If you aren't going to do the welding yourself, how do you find a welder? Pick up the yellow pages and start calling. Be prepared with a few questions. Ask if they regularly weld on firearms. Do they do work for local gunshops or gunsmiths? If they do, then you have found as much of an endorsement as you will need. A welder who regularly works on guns for a professional gunsmith will already know more about welding handguns than you will ever need to know.

If no one in your area already welds on firearms you will have to find a welder who is willing to try. Look for someone who works regularly with small parts. A welder accustomed to repairing tools for tool and die shops would be a better choice than a welder who repairs semi-trucks and trailers.

Once you have found a welder, how to "talk welding?" The first and most important thing to keep in mind is that you must describe results, not methods. Tell your welder what you want done, not how.

(1) Describe where the welding goes. Do not be embarrassed if you have to draw a diagram. Include dimensions. "A little bit here" does not help the welder. "Add 3/32nds from here to here" does. In determining just how much you want added, remember that you cannot weld up to exactly the finish size you need. You must weld past that size and file or grind the welded metal back down to fit.

(2) Explain what the part will be subjected to. A weld on a part that withstands repeated impacts, like a frame or a slide, must be tough, or it will crack. How tough is tough can be tricky. A weld that is too hard will crack from the repeated vibrations of cycling. Too soft, and it willpeen and deform. The better your description of the part's function, the more likely your welder will give you the right weld.

(3) Tell him how hard the weld must be. If you have him weld with harder metal than you need, you will have a tough time filing or grinding the bead. I tell my welder what method I will be using to fit the part-filing, grinding, or machine cutting with a lathe or mill. When I have to file a part, I ask for “just hard enough, but not too hard.”

(4) If you know, tell him the composition of the parts. It can be difficult to get a good weld between two parts made of dissimilar steels. If the welder has to guess at the alloys, he may be wrong, and your parts may not stay together. The manufacturers of handguns and parts often give a steel industry standards number describing the composition of the steel. Look for a four digit number such as 4140, 1020, 1030 in either the manufacturer’s catalog or Brownells. The number is a shorthand code for the exact steel alloy used. Knowing the alloy, you know how to heat treat, and how to weld, the parts.

Stainless steels use a different numbering system. What matters to the welder with stainless, though, is not the exact alloy used but whether your parts are ferrous, or magnetic. A stainless alloy with so much chromium or nickel in it that it does not attract a magnet requires a filler rod of a different composition than a ferrous stainless.

Don’t worry about what the numbers mean. Just find them out, if you can, and tell your welder. He’ll take it from there.

(5) Is there any additional information the welder has to know? European American Armory pistols, for example, are heat-treated to be very hard. If you have your EAA pistol welded, and the welder does not anneal (soften) the parts and the weld, you will never be able to mill, drill, tap, or file the repair. The hardness of the steel will also affect how your welder welds, and the filler rod he uses.

Back in the “good old days” everything could be welded, and, due to the scarcity of parts selection, often had to be. When I started shooting competitively there were just two choices for thumb safeties: the old, original, really small design, or the new, improved, somewhat larger size. (By today’s standards, the somewhat larger one was still really small.) If you wanted anything other than these two, you had to weld up a spare thumb safety and file it down to the shape you wanted. These days Brownells has almost four full pages of thumb safeties. Unless you want the practice, do not weld up a thumb safety. Just buy it.

Back then, match barrels were few and far between, and always very expensive. Rather than pay all that money only to wait months to get one, then wait again while it was fitted, shooters customarily would have a pistolsmith weld up and re-fit the barrel they already had. Welding offered a cheaper, if not always successful, alternative.

Grip safeties were also welded larger. Sights were welded into their slots and the slide re-machined for new sights. I have even heard of cases where shooters had a welder build up the rails of a frame, so the slide could be lapped to fit without play. That takes a welder with a delicate touch, indeed!

One pistolsmith by the name of Claudio Salassa was so good at artistically welding and sculpting old parts to look like new parts that he was lured from South Africa to Texas by the Briley company. He arrived in the United States right at the beginning of the expansion of the aftermarket parts field. Luckily for Claudio he was equally skilled at designing new parts and re-fitting existing parts. Today there are so many parts available that no one welds to build parts, only to repair them.

For example, the grip safety on a 1911 is sometimes mis-fit. The grip safety pivots in the back of the frame, and when properly fitted must be depressed to allow the trigger to move.

The safety bar must engage the trigger bow, or the pistol may fire even when the safety is not depressed. In the past, some shooters found that their hand did not fully depress the grip safety. Before the improved grip safeties that are larger at their lower ends were available, shooters who couldn’t fully depress the grip safety would file or grind off the tip of the safety lug, allowing the pistol to fire without the grip safety being depressed. You’ll sometimes encounter this on a used competition pistol, where the previous owner didn’t want the safety to work.

To repair such a situation, you can either buy and fit a new safety, or have the tip of the old one welded up, and re-fit the safety bar/trigger bow engagement.

Sometimes an experimenting shooter files or grinds his frame to take a new, beavertail safety. If he gets a little carried away it can create a different kind of mis-fit. I once saw a grip safety “fitted” to the frame of a Colt 1991 which had such large gaps I was afraid to fire the pistol for fear of being pinched by the safety and bleeding all over the gun. This repair requires welding the edges of the frame to fill the gaps, and then filing down the weld until the space between the safety and the frame is a thin line, and not the Grand Canyon.

Cracks on the frame can be repaired by welding. As mentioned in Chapter 4, in the section “Buying a Used 1911,” some cracks (such as the crack commonly found on the left side of the 1911 frame rail) should just be ignored. Others, either because of function or aesthetics, should be fixed. Some shooters find a cracked dust cover on their 1911 objectionable. Welding it is easy.

Welding a mis-ground feed ramp can be a headache. Some shooters, eager to improve the feeding of their 1911’s, but disinclined to read up on the proper method, sometimes just round off the top of the frame ramp. This “improvement” makes feeding worse. If you find yourself in possession of a firearm that’s been damaged this way, your only option is to weld up the top of the frame ramp and re-cut the frame to the proper dimensions. You’ll probably make several trips to the welder before you’ve completely filled and smoothed the repair.

If a trigger body is over-filed to fit into the frame it will rattle around in its slot. Welding to re-fit can salvage it. Since a new trigger is a only few dollars more than welding the old one, a trigger repair can offer some good, cheap practice — for you and for a new welder.

One thing you absolutely must not repair is a cracked slide. A cracked slide must be replaced. Welding a slide for new sights is fine. If the old sights have been replaced too many times the steel can require repair. Or if they are an obsolete design, the old dovetail slots may need some welding up and filing down before your new sights will fit.

Outside of 1911's there are very few pistols that crack and require welding. I have seen some Beretta M-92's with many, many rounds through them whose frames were cracked. Each time, the frames were already so worn that welding the cracks would have been a waste of time. In one case, the pistol was unserviceable due to a chunk broken out of the frame — clearly not a candidate for welding. I have never seen a Smith and Wesson pistol crack, even after being dropped. One, dropped from such a height that the frame was twisted and could not be reassembled, still had no cracks.

Sometimes Smith and Wesson revolvers crack at the thinnest part of the frame, where the barrel screws in. The very thin steel here cannot take the stress of unscrewing the barrel without proper support. It may also crack if the barrel is screwed on very tightly. The crack is not due to a design fault of the Smith and Wesson. If you replace barrels the proper way you will never crack a frame.

Welding this crack is somewhat involved, but easy compared to filing down the weld and re-tapping the frame. Leave it to a professional pistolsmith.

Doing your own soldering

Unlike welding, soldering does not require elaborate equipment and a dedicated wing of the fallout shelter. I've yet to have a soldering job spark at me. As long as you keep flammable materials at a safe distance, you can solder in a frame building. Try to avoid carpeting. If your space is already carpeted, and you'd like to keep it that way, invest in a sheet of thin plywood or one of those hard plastic mats designed for the wheels of an office chair. Either will protect your carpet (or good wood floor, for that matter) from the occasional, but inevitable, drips of molten solder. Drip on your carpet, or drop a hot part on your wooden floor, and just try to repair the damage. The plywood or plastic mat will clean up pretty easily, if you want to bother.



For soldering, you can use propane, the small tank, or acetylene, the large tank. I often use both, with one in each hand to evenly heat large parts.

As a heat source for professional silver-soldering you can use a pair of propane torches, available at the local hardware store. I have found the "Bernz o matic" brand works just fine. If you plan to do many soldering jobs with large pieces of steel you should consider an acetylene torch. An acetylene torch for soldering is different from the oxyacetylene used in welding. An acetylene torch uses the air around the torch as a source of oxygen, instead of the tank of pure oxygen required for oxyacetylene. Acetylene torches are not nearly hot enough for welding, but for soldering, acetylene has one big advantage over propane: It commonly comes in tanks much larger than propane. That means acetylene torches can take a larger nozzle and heat a larger area than a propane tank can.

You will need gloves and your work apron. Also wear safety glasses. You don't need welding goggles, but you should have some protection for your eyes. Your shooting glasses will do.

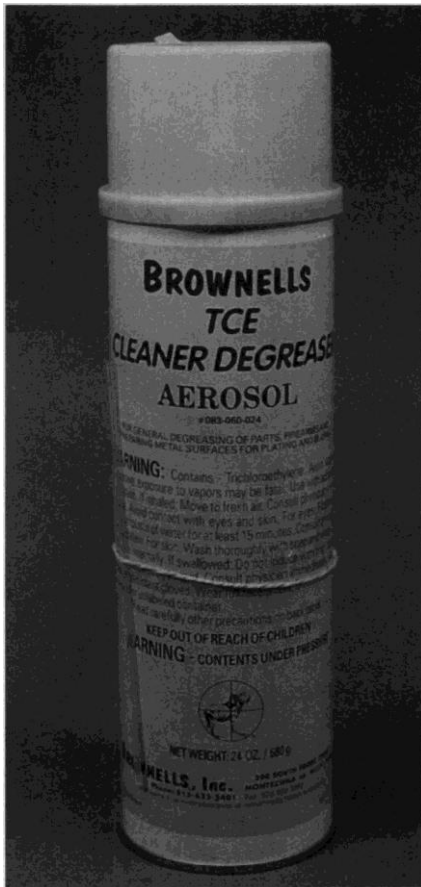
You will need solders and fluxes. Buy solder designed for the job you're doing, and the strength your repair needs. Buy the flux specific to that particular solder. While you may be able to do all your work with one type of solder, you will never make all types of solder work with one flux.

Buy soldering talc. This white talc bar looks similar to your filing chalk. Since solder will not adhere to it, apply the talc to areas you do not want soldered. Suppose you want to solder a front sight base onto a barrel or slide. How do you prevent solder from flowing out of the heated joint and hardening on an adjacent area? Talc that area first. The solder still will flow out, but it will no longer adhere. The talc prevents the solder from sticking.

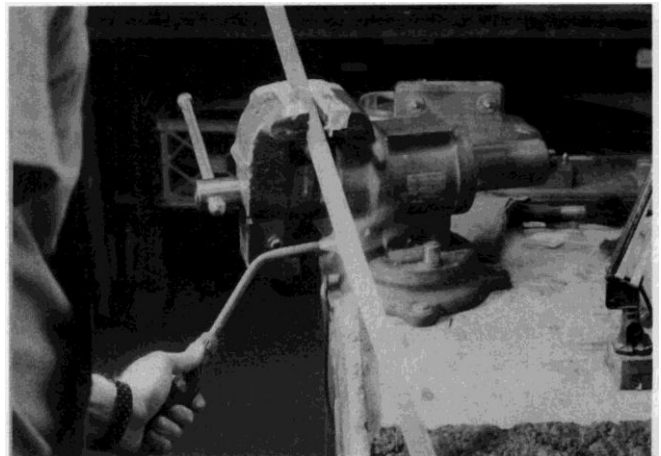
Rather than experimenting with solders from the local hardware store, use your Brownells catalog. Their solders will all be suited for use on firearms. All you'll have to do is decide which one is best for your application and which flux goes with it.

When buying solder, use only high-temp silver solder. It comes in wire, sheets, and a really neat homogenized mixture. The mixture is a paste of the solder and its flux, packaged in a plastic syringe and ready to apply. While each of these requires a slightly different method of soldering, the preparation for all is the same. In welding you can weld together parts whose initial fit was poor. Not so in soldering. Because a strong joint depends on a thin film of solder rather than a large glob of it, a strong solder job depends on a tight mechanical fit of the parts. After you check your parts for fit, (and file, if necessary) you must be sure they are cleaned of dirt, all surface finishes and any oxidation. A thorough de-greasing is essential. While a good, clean surface is important in welding, it is imperative in soldering. Solder cannot bond through contaminants, including bluing, plating, or your fingerprints.

Soldering practice is easy. To start, clamp the largest part firmly in your vise. Use the flat bars you filed and drilled in Chapter Six. If the largest part is not held firmly, you can make a great mess and even burn yourself. Spend some time arranging the part so that it is level, you can get to it easily and the direction of the flame is not pointing at something flammable, including you. If the largest part is not held level in your vise, the smaller part can shift when the heat is applied. It may even fall off the rest, and onto something you'd rather not damage. Your carpet, for example. Or your leg, or hand, if you forget and try to catch the hot, falling part. Let the plywood or other covering you've put down catch the hot part. That's what it's there for. A few minutes spent planning will save you starting all over again.

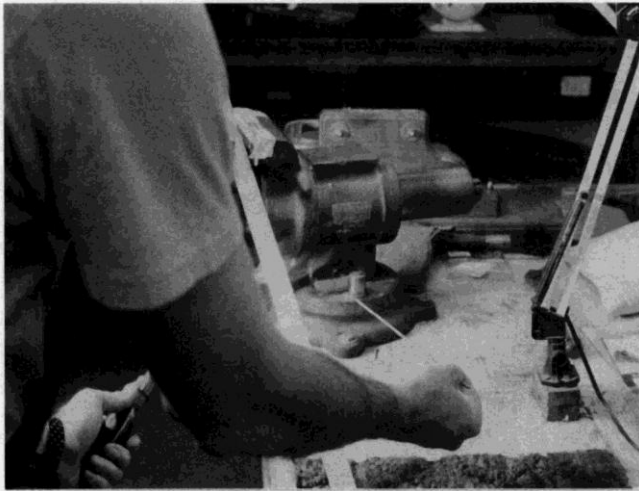


The area being soldered must be clean and degreased. Spray and dry several times with an aggressive aerosol such as this Brownells TCE.

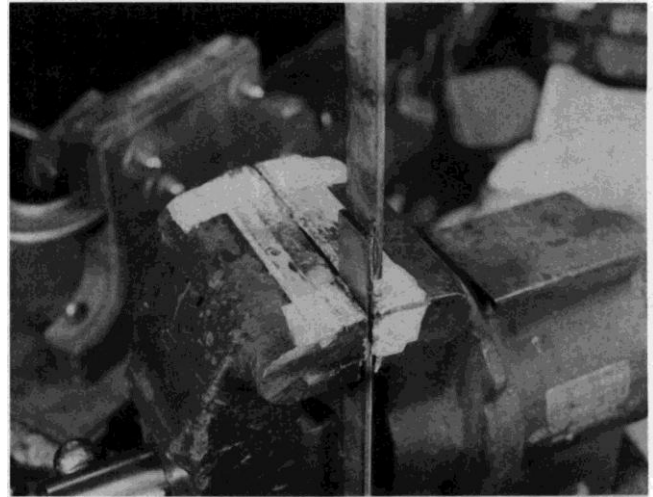


Silver-soldering with an acetylene torch

Since excess solder will run out of the joint, you must apply soldering talc to prevent its adhering to the surrounding area. Rub the talc around the area you will be soldering. When soldering a barrel, add talc not just next to the sight base, but all the way down under the barrel. Otherwise, the solder can run right past the talc, and stick. Talc the sides of the sight base, or the solder can wick up the base. If you are using the homogenized mixture, your preparations are complete here. Do not flux. With wire or sheets of solder, continue. On your practice bars, clean and flux 1/2 inch of the ends.



Once the area being soldered is up to temperature, the solder is touched to the joint.



Practice on flat steel, and test your work. Clamp one flat and bend it using the other end as your handle. A good solder joint out of high-temperature silver-solder should break the steel before the joint lets go.

Brush your flux where you will solder, and only there. Do not use too much! Solder will follow excess flux.

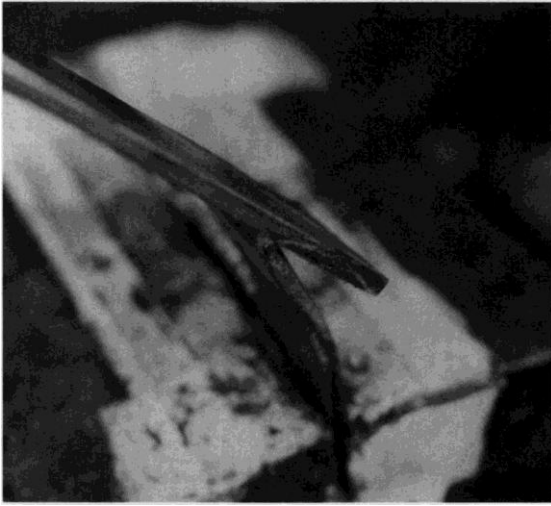
The most common mistake for a person new to soldering is insufficient heating of the parts to be joined. You cannot heat the solder, let it run into the joint, and call it a solder job. You must heat the juncture of the parts past the melting point of the solder, and then introduce the solder. Once bonded, you must leave the repair quite untouched until hardened. As with any glue, if you shift it while the solder is cooling the joint will be weak. And crooked.

Your preparations for soldering are now complete. What you do next depends on the type of solder you have. Wire is the standard, and oldest, method. Place the prepared and fluxed parts together, and begin heating them. Heat the largest part first. Let the heat flow to the smaller or thinner parts. Once the parts are up to the solder's melting point, hold the flame on one side of the joint, and touch the solder wire to the other side. The solder will melt, and flow into the joint. Keep feeding wire into the edge. The solder will wick through the fluxed joint towards the heat. When you see solder come out on the flame side evenly across the joint, pull the solder away and remove the flame.

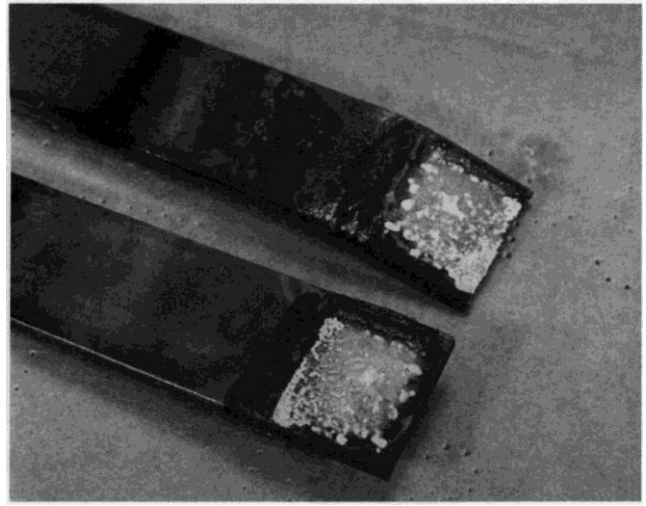
With sheet solder, cut a piece to the size and shape of the joint. Place this piece between the fluxed parts, and then start heating. The color of the steel will let you know when you've reached the solder's melting point. You will see the edge of the solder melt. Remove the heat.

The homogenized solder comes in a syringe. Squeeze enough of the solder/flux paste to cover most of the surface, but don't overdo it. Not only is the mixture expensive, the joint will be stronger with a thin layer of solder. Press the parts together briefly, pull them apart, and look. If you have most of the surface covered with solder paste, you're all set. Put the parts back together. If the surface is not mostly covered with solder, add more. If you've added too much, carefully scrape away the excess solder that oozes out when you press the parts together. Once the gap is completely filled with a thin layer of solder paste, heat the joint to the solder's melting point. Remove the heat.

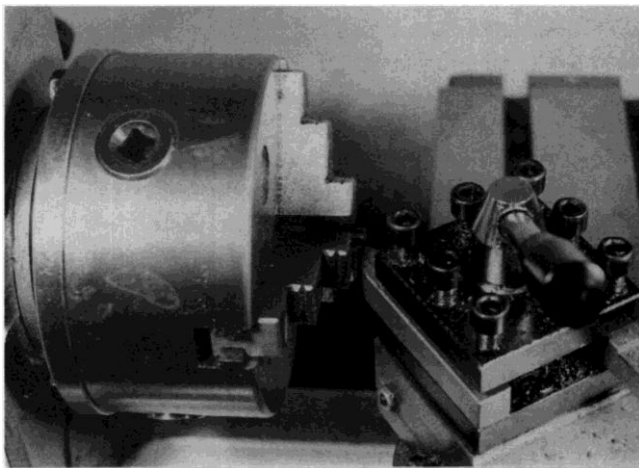
You've soldered your practice bars together. Let them cool, and then test your soldering abilities. Clamp one of the bars in the vise, just under the soldered joint. Flex the other bar back and forth, stressing the joint and the steel just under it. You should be able to flex the steel until you break the bar. The soldered joint should hold. If your soldered joint lets go, practice some more.



After a small bend, this joint fails.



A post-mortem reveals a lack of heat. The solder was not melted enough to form a good bond, and failed.



Here the extended magazine button is being turned down on the lathe.



The extended button on the left, with a standard button on the right. You don't need much extension to make a difference in your reloads.

Common reasons for weak solder joints include: lack of solder flow into the joint, insufficient flux, and too much solder. The first is caused by insufficient heat. Do not be afraid of heating the job past the indicated melting point by 100° to 200°. If you were stingy with flux, try again and use more. A joint with too much solder usually means you rushed your preparations. Start over, and check each stage of your work.

Projects:

Extended magazine button

Our first silver-solder job is the easiest, but requires a lathe to clean up and finish. Find someone who will turn your part once it is soldered. If you want an extended magazine button, but do not have access to a lathe, go to Chapter 18. That's where we cover the drill and tap method of extended magazine button installation.

The magazine release button on the 1911 is rather short, and some shooters find it hard to press. By making the button longer, you can make releasing the magazine during a match easier. Remove the button from the frame, and the spring and plunger from the button. File the ridged end smooth. Some buttons will be slightly surface hardened, and your file may have a tough job of it. You can use the bench grinder to clean off enough of the ridges to make your filing easier.

Take a 3/8-inch diameter mild steel rod, and file an end of it smooth and square to the rod's length. Hacksaw a piece off this end about 3/8-inch long.

Clamp the magazine release in your vise with the end to be soldered sticking up. Do not clamp too much of the release in your vise or the vise will act as a heat sink, and you will not be able to get the parts hot enough. I prefer to use the homogenized high-temperature solder for this job. Squeeze a small circle of the solder paste onto the release, and press the extension down onto the release, and heat the parts. For this solder, the melting point is 1125°, and I heat the joint up to a medium cherry red, 1250°.

Once the part is cool, turn on a lathe to bring the extension diameter down to that of the button, and check the end. Do not make the button too long. I find that a long button gets in the way of my left hand, and I can actually drop the magazine while shooting. Also, if you have to shoot in a match where the pistol starts lying on a table, a magazine button that is too long can press against the table, and you may find your magazine dropping out as soon as you pick it up.

Soldered grip screw bushings

Grip screw bushings on the 1911 occasionally come loose. Rarely, loose bushings strip their threads. Rarest of all, a stripped thread bushing is one that has already been replaced with an oversized bushing. There is not an over-over-sized bushing. Take the bushing, and once you have it free from the grips, set it aside. Strip the frame. Check the bushing fit in the frame. It cannot be loose, there must be some mechanical fit. Place your frame bar in the frame of the pistol, and using the frame bar as a backer, stake the edges of the hole until the bushing can barely be pressed into place. Pull the bushing out, degrease the bushing and frame, flux the hole and bushing, and press the bushing in place. Remove the bar. Clamp the frame so you can easily get to the bushing with your torch. Heat the bushing and frame, and when you are up to temperature, touch the solder to the bushing/frame juncture.

When cool, scrub the frame clean and check to see that a magazine will freely enter and drop from the frame. If it doesn't then solder inside the frame is binding the magazine. File the solder until the magazine drops freely. Run a grip screw tap into the bushing to clean out the threads, and attach your grips after you have assembled the pistol.

Adding a palm pad to a grip safety

Some shooters find that the grip safety on their 1911 does not always release the trigger. This is because of the way the shooter is holding the pistol. The grip safety was designed in 1911 to work with a single-handed, thumb under the safety grip. With the thumb on the thumb safety and a higher two-handed grip, the bottom of the safety is not always pressed down enough to release the trigger bar. The answer is not changing your grip, but filling the gap. One way is to switch to a new grip safety that already has a palm pad. If you already have a safety that feels good, why buy another?

Remove the safety from the pistol, and clamp it in the vise with the lower end sticking out to the side. With your 10 inch second cut file, file a notch on the end, starting 1/2 inch from the end. Do not file this notch so deeply into the safety that you come to the hammer strut clearance slot. File until you have gotten down 1/4 inch. Take a piece of mild steel, and file a chunk that will fit the notch you have filed in the safety. The top of the chunk should stick up from the safety enough to fill the gap between the safety and your hand, at least 1/4 inch. Degrease and flux the safety and the chunk, and silver-solder the two together. When cool, round the edges of the safety extension so they do not abrade your hand. Polish and refinish.

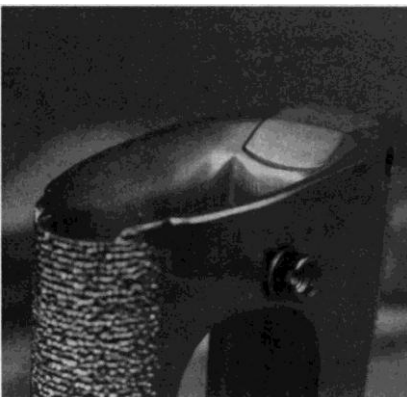
Soldered-on magazine funnel

The bolt-on magazine funnel is covered in Chapter 18. If you want the simple approach, skip ahead. The elegant and permanent method takes more work and should be left to the professional. It involves soldering a magazine funnel onto the frame of your 1911. There are two styles of funnel, a pre-machined one-piece funnel, or a two-piece funnel. Each uses a different method of attachment. I explain the process for those who are curious, but recommend you wait until you have much experience with soldering and with grinding, filing and polishing.

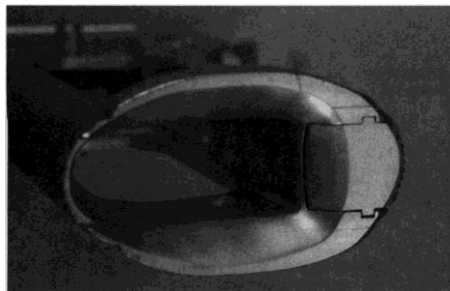
For the one-piece funnels, you must file, grind or machine off the bottom 1/4-inch of the frame. You lose the holes your mainspring housing pin go through, and must re-drill them. To do this you must have a locating fixture. The new funnel attaches over a small surface area. If your soldering is not precise the funnel will fall off.

The two-piece magazine funnel does not require elaborate equipment, and you do not lose (and then have to re-locate) your mainspring housing holes.

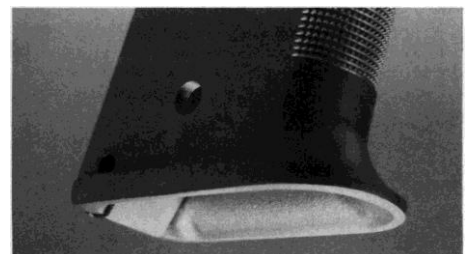
It does require a delicate touch soldering, and hours of grinding and polishing. I use mild steel "gauge stock" that I obtain from my local machinists supply store. If you use 1/4-inch stock, your funnel will not be quite as high as the thickness of the grips. If you use 3/8-inch stock, you will have to do more grinding and filing, but the funnel will be flush with your grips. Cut two pieces just a bit longer than the frame at the bottom. Strip the frame and remove the lower grip screw bushings. Polish the frame where the funnel will be soldered on, and one side of one of the pieces. Degrease and flux the polished surfaces. Clamp your frame in the holding bar, sticking out of the vise level with the floor. Place the gauge stock piece on the frame, at the bottom, and heat and solder. You do one side at a time. When one side has cooled, remove the frame from the holding bar and clamp it in the drill press. Using the mainspring housing hole from the other side as a pilot hole, drill your new piece through with a #21 drill.



The end-product of a two-piece magazine funnel. The result of at least ten hours of soldering, grinding, filing, polishing and fussing.



The magazine-view of a magazine funnel. If you miss this, you need a white cane. Or more practice.



You can avoid the hassle of trying to solder on a magazine funnel, one piece or two. Just order a Caspian frame with integral magazine funnel.

Polish the other side of the frame, and the other gauge stock. Solder these together. You can solder the second piece without loosening the first piece if you heat the second piece from below and at a slight angle. Done properly, the flame will be split by the inside edge of the frame, with half the flame going up the inside of the magazine opening. The torch will not heat the first piece enough to affect the solder. If you heat the second piece from above, the flame going past the second piece will heat the first piece enough to loosen it. With the second piece cool, drill the second hole using the first one as a pilot.

Now you've done the easy part. The hard part is to grind, file and polish the exterior flush to the grips, and the interior as a funnel. This is advanced work, and best left as either a job for the professional, or our next pistolsmithing volume.

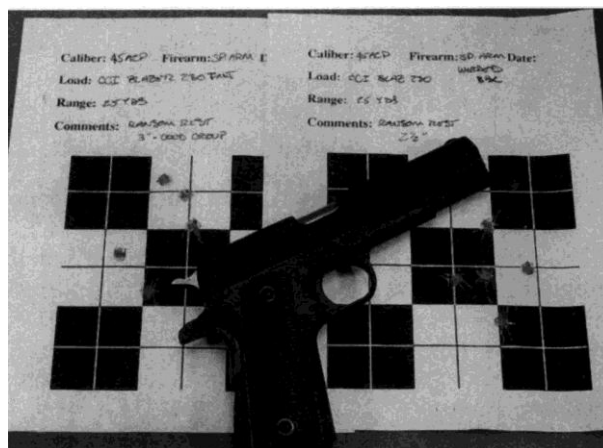
The Medium-old days: Welding a barrel

As an experiment and demonstration I welded and re-fit a barrel as we did in the old days. The test pistol was a Springfield Armory 1911A1 in .45 ACP. I used it only because it was available, and not to pick on Springfield. The cost savings over a new, match barrel were appreciable. The welding cost \$25. A match barrel runs \$125 to \$200. The amount of work to fit the welded barrel was only a little more than the work needed to fit a match barrel. The accuracy gained? Almost none. Out of the Ransom rest, the factory barrel before welding delivered 3-1/2 inch groups at 25 yards. After welding, group sizes "shrank" to 3 inches on average. I say "shrank" because the groups still varied in size. Largest to smallest, the groups varied from 2-1/2 to 5 inches. Only by averaging the sizes of a number of test targets could I determine that the welded barrel had improved. I would have had a greater improvement in accuracy from installing a match bushing instead. My experience with the combination of welded barrels and match bushings is that the welding doesn't help at all, but the bushing does.

The match barrels? The Olympic barrel delivered 2 inch groups with very little change in group size from target to target. Groups from the Bar-Sto and Kart barrels hovered around one inch. Do not bother welding barrels.



A 1911 barrel with the hood and bottom lugs welded and re-fit to the frame and slide. This used to be common in the old days, but now is a complete waste of time.



The barrel on this Springfield armory 1911A1 was welded and re-fit, for not much results. Groups went from three inches to two and a half inches.



The owner of this barrel was not so lucky. The barrel was heated too much in welding, and the hood broke off after a few thousand rounds. He wasn't hurt, but he was very angry.

Chapter 9 - Refinishing

“This new stuff rusts.” (Anonymous, 1000 B.C.)

The newest high-tech wonder weapon has just hit the agora, or marketplace. All over Greece and Persia, sport hunters and would-be Olympians are clamoring to get their chance to try a great new metal. Iron, they hear, will change everything. It's stronger, harder, all around better. Just one itty, bitty, corrosive little problem. But then, it's always something, isn't it?

Iron was a definite step up from bronze. It was also more difficult and more expensive to manufacture. When blended with other elements, iron becomes an alloy. The alloy we call steel is iron with a certain percentage of carbon in it. Carbon imparts strength and hardness. Other trace elements in the steel improve machinability, allow forging, or change its response to heat-treating. A “hardening” steel is quickly heated and cooled, changing its crystal size, and thus its hardness. A “stainless” steel has chromium and nickel mixed in it. Many people believe stainless steel does not rust, but it does. Takes a long time, though.

Not merely an aesthetic affront, rust can impede proper function and destroy an iron/steel mechanism. Oddly enough, the very first protective finish “applied” to iron was rust. By carefully controlling the process, a somewhat preservative rust layer can be built up. For almost 3,000 years, it, and scouring the iron bright, were the only finishes available for iron implements.

Right up past the American Civil War, scouring rifle barrels bright with a wet application of campfire ashes was considered an appropriate method of cleaning and maintenance. The barrels, manufactured of what was then called steel, are barely that by today's standards. It was not until the Bessemer process came into common industrial use right after the Civil War that good-quality steel could be produced in volume and cheaply.

Steel is much stronger than iron. It is also amenable to chemical protective finishes.

The question always arises: Do you really need to have some kind of finish on your handgun? Well, no. A stainless handgun, for example, will rust only if exposed to severe conditions and massive neglect. With some regular work, carbon steel also can be left bare. One of the competitive shooters in our area is such a compulsive parts experimenter that trying to keep his pistols in any kind of finish is impossible. Rather than have his pistol a patchwork of parts, all differently finished, he simply bead blasts his pistols clean. Mark is well-known for shooting “bare” guns. He also keeps them coated in oil, to protect the steel.

Most shooters do not constantly experiment. Even fewer have a bead-blasting cabinet in their basement. While you are making modifications to your handgun, go ahead and leave the steel mismatched or bare. Once you're set, protect your work with a good finish.

Protective finishes for your handguns come in two types. The first and oldest—browning, bluing, color case-hardening, and Parkerizing—result from a chemical reaction with the surface of the steel itself.

Instead of merely browning, steel takes on a deep blue color when rusted with the appropriate chemical mixtures. Steel also can be heated to oxidize the surface. When heat-soaked in ovens at the right temperature, the resulting “fire blue” is very striking. Colt, in their 1936 centennial celebration book, described their then state-of-the-art heat-bluing process. It would give the EPA of today an attack of the vapors. Then, as now, a good finish required a completely degreased surface. To secure this, Colt would dunk racks of polished handguns into tanks of boiling gasoline! Then off they'd go to the bluing ovens. The finish sure looked nice when they were done!

Heat bluing of small parts offered manufacturers a one-step way to draw the temper of heat-treated or forged parts, give them color, and protect them from the elements. The small parts on Luger pistols are a yellow color, called “straw.” The manufacturer heat-blued them, stopping short of bringing the steel to the full blue color. You will be heat-bluing small parts in the projects to come.

As attractive as these finishes are, they are not any more durable than the old browning method. Firearms manufacturers looked for a more lasting method. Hot bluing, a boiling solution of caustic salts, proved more durable than browning, rust-bluing or fire bluing. By the standards of yesterday, it was a big advance. By the standards of current coatings and platings, even hot-dip blue is hardly effective against corrosion.

The second type of finish includes chrome, nickel, gold, or even paint. Coatings or platings that adhere to the steel, they seal it away from oxidation. Firearms manufacturers and aftermarket firearms refinishers are constantly developing combinations and improvements of these finishes.

Before WWII, if you wanted to blue your handgun, you bought the assorted chemicals and mixed the bluing solution yourself. In his book "The Modern Gunsmith," last updated in 1941, James V. Howe listed over 50 formulas for various firearms finishes, none of which could be purchased over the counter. The raw ingredients needed to mix the formulas included nitric acid, hydrochloric acid, sulfuric acid and copper sulfate, combined with alcohol and chased with a whiff of distilled water. One formula, my favorite, used potassium cyanide to touch up color case-hardening!

Today, any finishing that can be done at home is done with pre-mixed chemicals. Brownells offers pages of solutions and tanks, ready for you to set up and start the work. You might be tempted to try. But should you?

No. Except for a few finishes that you can apply without going to the trouble of setting up a separate room for the process, re-finishing work should be left to the professionals. The first one that you can do yourself is chemical cold blue. The second is heat blue of small parts with a propane torch. The third is Brownells bake-on epoxy finish. The fourth is cold rust blue. The last is Brownells Amer-Lene cold Parkerizing. Any other finish that you may be tempted to apply to a firearm requires tanks, chemicals, heat or electricity, and ventilation. The cost of the equipment alone easily exceeds that of a dozen bluing jobs done for you by a professional. And you still need a dedicated space. Remember that bare, empty room we talked about for welding in Chapter 8? You need the same kind of room for hot-dip bluing or plating.

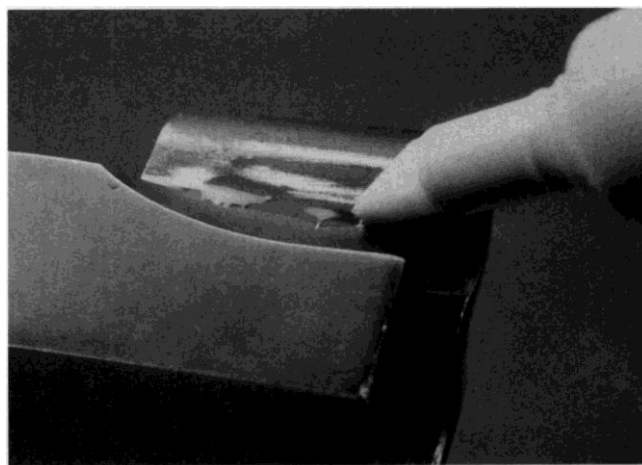
Cold blue

Cold bluing, or chemical bluing, is used to touch-up slightly worn or nicked blued finishes. It is suitable for covering up the holster wear on the muzzle of a revolver, or a spot on a slide where your sweat lifted the blue. It is not nearly as durable as a hot-dip blue finish. Some cold-blue formulas contain sulfides, and a handgun that has been touched-up too much can have a very slight, but noticeable, smell of rotten eggs.

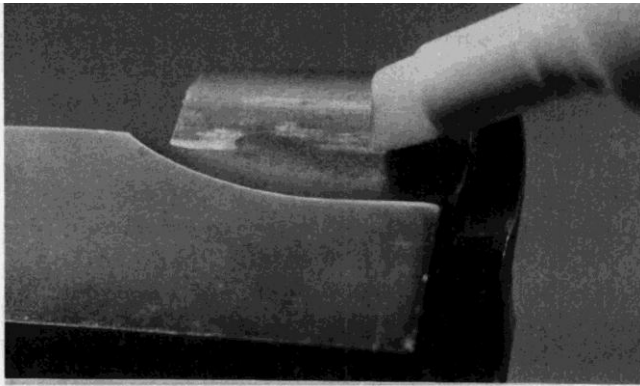
My standard cold-blue solution is Brownells Oxpho-Blue. It gives a reasonably durable finish and can be applied repeatedly until the color is dark enough to match the existing finish. To use a cold-blue solution first scrub the area to be blued with 0000 steel wool and light oil. Clean the surface of powder residue, mild oxidation and any pre-existing finish that is ready to lift off. Obviously, you don't cold blue a handgun with a plated surface, or a stainless steel handgun. Once scrubbed, thoroughly degrease the area. Clamp the handgun in a padded vise, and bring your work lamp close to the surface. Use the lamp to warm the area you're working. With a cotton swab, brush the Oxpho-blue onto the steel. Leave it on the surface for a minute, then polish with dry 0000 steel wool. Degrease, and apply the Oxpho-blue again. Repeat until you get the color you want. Oil the surface to finish the process.



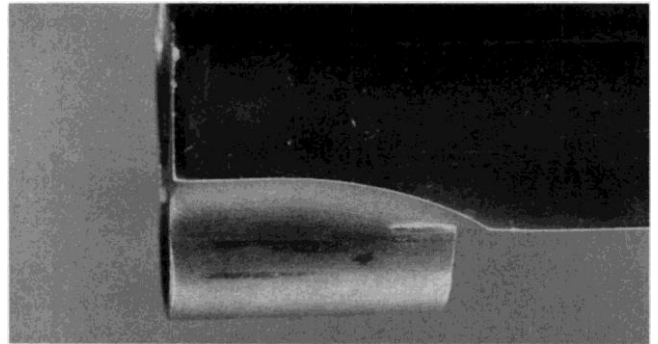
For a quick touch-up of blued handguns, Outers makes a felt-tip pen applicator set. Clean the steel, touch it up, and give it a final wash.



This is the cleaner being applied.



Now the bluing solution. You can see that some of the bright metal is already reacting.



The touched-up slide. The only way to see the cold-blued area is to angle the light.

Heat blue

To heat-blue small parts requires a propane torch and oil. You must use a petroleum-based oil. A modern synthetic lubricant will not do. Have the oil in a small cup or jar. Polish the surface of your part to a texture that will match the rest of the handgun. Degrease the part, and holding it with a pair of needle-nose pliers, play the propane torch on the surface to be blued. As the part heats up, you will see the surface turning colors. First you'll see the straw color of a Luger, followed by violet, light blue and finally Colt fire blue. If you heat too quickly the part will pass right through all four colors and turn white again. You'll have to let the part cool, buff the surface to remove oxidation, and begin heating again. When the part is hot enough that the surface has turned a light blue, drop it in the oil. The oil will darken the blue finish. Remove the part and let it cool. To finish, buff the surface with 0000 steel wool and oil.

Practice will let you easily gauge the right moment to drop the part into the oil. If you don't want a dark finish, let the part air cool without the oil bath. For the darkest finish, immerse the part in the oil when hot, fish it out of the oil with pliers, and use the torch to briefly burn the oil off the part.

You can only heat-blue small parts. To heat-blue a slide evenly takes a temperature-controlled heat furnace, which costs as much as a dozen bluing jobs on your handguns.

Bake-on finishes

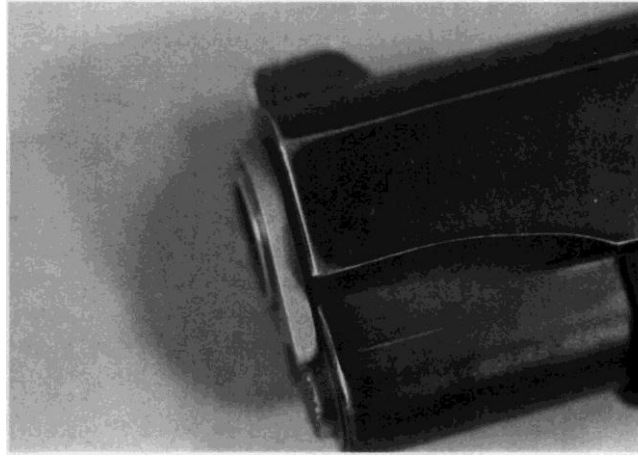
The Brownells baked-on epoxy finish is simple, reasonably durable, and does not require a large investment in equipment. It turns a bright stainless or plated handgun an even black, brown or green. If you want to, you can even get all three colors, and apply your own camouflage pattern. The final finish looks like paint. It smells bad when you bake it.



Brownells backing lacquer is available in several colors, gloss and matte, and is easy to apply. While not greatly durable, it is better than standard bluing and can be touched-up when it shows wear.



The Brownells Teflon/Moly oven cure finish offers greater durability than the baking lacquer.



This is Amer-lene Parkerizing covered with Brownells baking lacquer. After five years of daily carry, 5,000 rounds of ammunition, and two trips to Gunsite, this is all the wear that shows.

Brownells offers two finishes, with pretty much the same application process. One is the matte or gloss Baking Lacquer. The other is their Teflon/Moly Oven Cure.

In order to hold the parts while you spray them and bake them you should make supports. For the slide I take scrap pieces of steel that fit under the slide. I wrap them in aluminum foil, to make cleanup easier. For 1911 frames, I just use my holding bar. Since you are heating only to 350 degrees, you could even cut supports from wood. Brownells suggests that you can apply the baked-on finish right over a blued finish. I prefer to apply it to bare metal for better bonding. Remove all of the old blue finish. Degrease. Take a blow dryer and gently heat the parts you will be spraying. Hold your hand close to the part to check its warmth, but don't touch it. Spray the finish onto your parts, and let dry for 30 minutes. Spray the finish on in even, thin coats, passing smoothly from end to end. For the Lacquer, give the parts three thin passes, for the Teflon/Moly, only two. While the parts dry, pre-heat a clean oven to 350°F. Also open the windows. Remember, the process smells. Bake the parts for 30 minutes. (Don't use any regular cooking pans for baking on your finish!) Cool. When done, wipe the oven with warm water and detergent. The finish is not poisonous, but do you want dinner tasting like it? I think not.

The resulting finishes are unaffected by oils and solvents. It will take some doing before they start wearing through. When they do, wet-sand only the worn area, degrease and apply a new "patch."

Another approach, not firearms specific, is to use a baked-on automotive engine paint. These are available in a variety of colors as well as basic black. A candy-apple red handgun? Hmmm.

Rust-bluing

Cold rust-bluing, used more in the past than today, does not require the kind of equipment needed for hot-dip bluing, but is a labor-intensive process that takes at least four days. Some of the old formulas even suggested 10 days or two weeks!

In a cold-rust bluing process the gunsmith would polish the steel, degrease it, and swab on the bluing solution. The firearm was then suspended over a tank of warm water, which rusted the steel. After rusting, any crusty sections were carded off with a wire wheel or brush, leaving the surface of the steel darkened. This process was repeated daily, with each day's start a dip in a boiling water bath. The finish on the steel became darker and darker. It took four days to get a good finish with the fastest formula. With some formulas the process could be continued until you got tired of it, and just couldn't wait to shoot the firearm. Oiling halted the rusting process, and protected the finish.

Modern improvements in chemistry have shortened the time, and reduced or removed the need for the warm water tanks to keep the surface humid. They have not removed the need for a tank of boiling water, or the carding of the steel over several days of waiting.

On a handgun for presentation or exhibition, a rust-blued surface can be gorgeous. To get that gorgeous finish requires lots of practice, patience and skill.

Amer-lene

The standard professional parkerized finish requires tanks of boiling phosphoric acid laced with dissolved filings of steel, zinc or manganese. Amer-lene is a zinc-phosphate process. With Amer-lene you still need a source of heat, but you can manage on a camp stove or a gas burner in the garage. I am specifically counseling against trying this on the kitchen stove.

Amer-lene, available as a concentrate, produces a dark gray-colored steel. This is the standard color of Parkerizing. You can make the parts black, or dark green, before or after you use the Amer-lene. Wear rubber gloves to protect your skin from the solutions. Mix into a stainless steel basin, according to the directions on the bottle. Since Amer-lene is a one-shot solution, mix only enough to cover the parts you are Parkerizing. Once the solution cools the chemistry degenerates, and cannot be reversed. Heat the mix. Place the stripped and degreased parts in the solution, and leave there for five minutes. Every minute or so, gently stir the solution to get complete coverage of your parts.

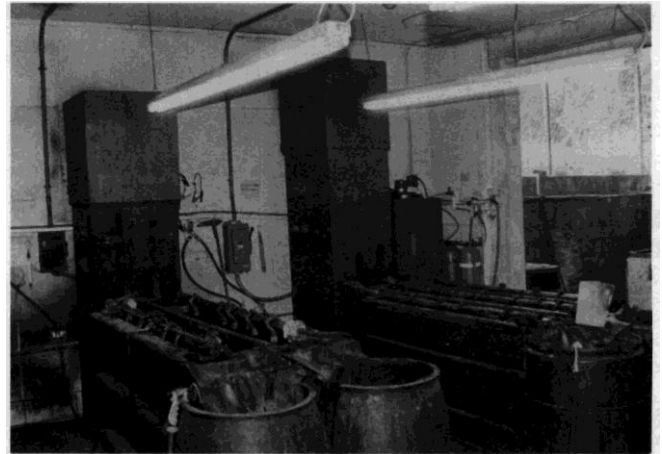
If you want a black finish, Amer-lene offers a pre-dip blackener. Pour the blackener into a fiber glass pan, and after you have cleaned and degreased the parts, dip them into the blackener, and then into the heated Amer-lene.

After five minutes, pull the parts out of the solution and immediately rinse them under cold running water for 30 seconds. Wipe the parts completely dry, or blow dry them. Spray with Amer-lene stop/seal. Because the spray stops the chemical reaction and seals the surface, adding corrosion resistance, make sure you soak the parts with spray. The parts are now ready for assembly. Clean with mineral spirits, oil and assemble. If you want your gray finish to be darker, vigorously rub a dark grease into the surface. The porous Parkerizing will trap and hold the grease, adding corrosion resistance as well as color.

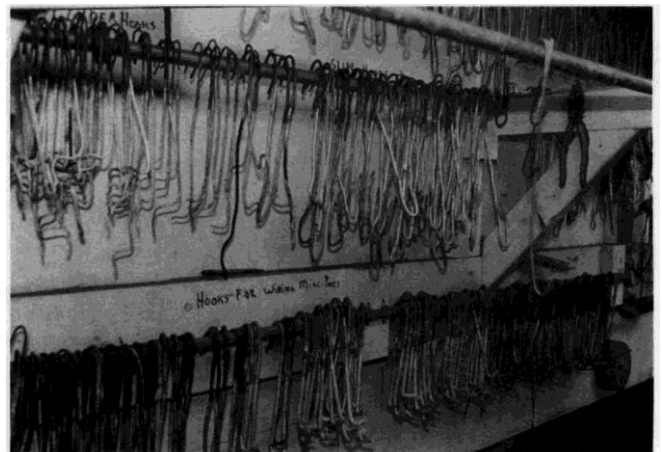
Amer-lene etches the surface of steel, so you should not treat the barrel. If you must treat the barrel's exterior, use neoprene plugs to block the muzzle and chamber.



The Amer-lene Parkerizing kit is one of the few finishes that can be applied at home.



Firearms re-finishing requires tanks, chemicals and lots of ventilation. This plating room at Accurate Plating uses the natural breezes of the Gulf of Mexico for ventilation.



Proper re-finishing also requires a means of holding the parts or handguns. These hooks have been custom-built to hold the frames, slides and cylinders.

Finishes applied by professionals

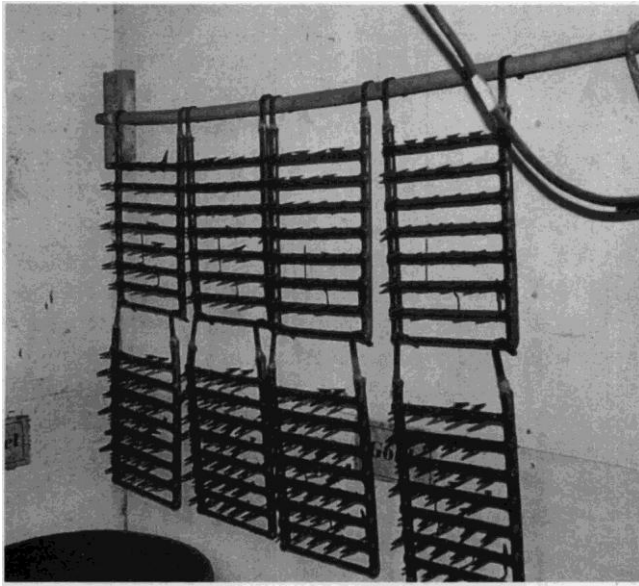
The most important part of any refinishing job is the polishing of the surface. Only baked-on epoxies or teflon finishes will hide flaws. Flaws in the polishing of the steel will show up in a blue or color-case job. Hard chrome or nickel will highlight any polishing errors. Polish out the flaws before you ship, as we discussed in Chapter Six.

If you do not want to polish out flaws in the surface of your handgun yourself, you can have the refinisher do it. Think about it first. Good polishing takes time, and the refinisher will be charging for his. At the highest hourly rate I have seen, two hours of polishing will equal the cost of the plating job itself. With polishing, a plating job can quickly become very expensive.

Whether or not you do your own polishing, try to see a sample of the refinisher's work beforehand. Look for pulled letters or dished screw holes. If you find any signs of these, go somewhere else. Check with local gunsmiths to find an established refinisher who will declare they go to all reasonable lengths to prevent pulling and dishing.

Unlike the home-applied finishes described earlier, which can be touched up or repaired, all of the professional finishes must go on whole. Once done, they're done. They cannot be touched up, and if you change your mind about what you want, too bad. For hot-dip blued handguns the cost of later "corrections" is not terribly high, because the process is simple: through the strip tank, into the hot dip, back to you. But if your handgun is plated and you make a change to it, the handgun must be stripped completely (think hydrochloric acid and sand-blasting) and then re-plated. It gets pricey.

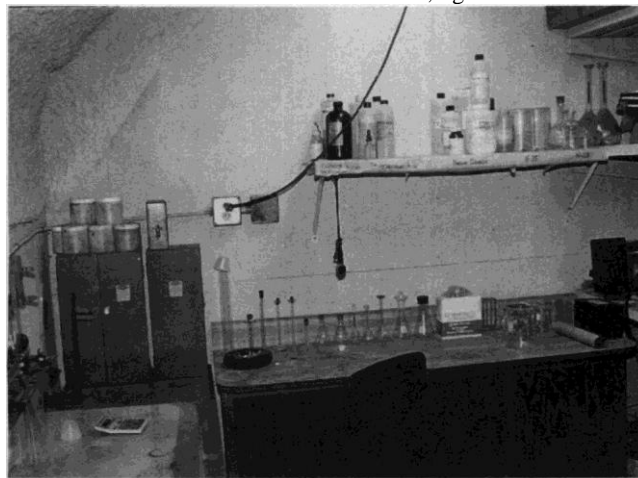
Look at getting your handgun plated as having it carved in stone. The very last thing you do to a handgun—no more modifications, no more changes to see if it'll be perfect now—is get it plated. Unless you like spending more money than you have to, only get your handgun plated once.



If the hooks and racks are not kept separated by process, they may contaminate other tanks.



If you think you might want to take up re-finishing as a hobby, look at the tanks, lights and ventilation needed for one room.



To control the solutions, a chemical lab on site is a must. Otherwise, improperly mixed solutions can damage valuable handguns.

Hot-dip bluing

The blue finish on your handgun is the best finish the factory can apply at a reasonable cost. Not everyone wants a nickel-, or chrome-plated handgun. Or one in stainless. Shooters' tastes have been firmly in favor of blued steel for a century. Using a solution of caustic chemicals heated to temperatures from 270° to 285°F, hot-dip bluing is considered the standard of the industry.

The process begins with a dip in a boiling cleaning solution to remove oil, gunk, wax, and fingerprints from the steel. Then, if necessary, the parts are polished or bead blasted. Next is an acid etching solution to remove any oils or oxidation accumulated during the polishing. This also removes any remaining blued finish.

Now the parts are ready to be blued. They go into and out of the caustic bluing salt solutions several times. When they reach the desired color, the parts go into a stop bath to neutralize the bluing salts. Finally, they go through a hot oil bath, to remove any water left behind by the stop bath.

If you want to take up bluing as a hobby, or yearn for a career change, I must warn you that over nearly 20 years, I have used seven different bluers. I don't know, maybe it wasn't from the chemicals, but they all seemed an unhealthy lot, and retired or even died at an alarming rate.

I strongly recommend against hot-dip bluing at home.

The particular chemical solution used by a factory or a re-finisher really doesn't matter. Any hot-dip solution can be used on all carbon steels, including springs. Tossing a stainless part in the solution is a waste of time, as the part will come out looking dirty, not blued. On anything but stainless, all hot-dip methods produce a dark blue, almost black finish. While attractive, this finish will not cover pits or errors in polishing. It is not durable. If neglected, it will quickly rust.

If you have a pitted handgun which you want to blue, have the refinisher use a relatively coarse medium to bead blast the surface. A coarse bead blasting will diminish the look of the pitting, without creating the ripples seen with buffing.

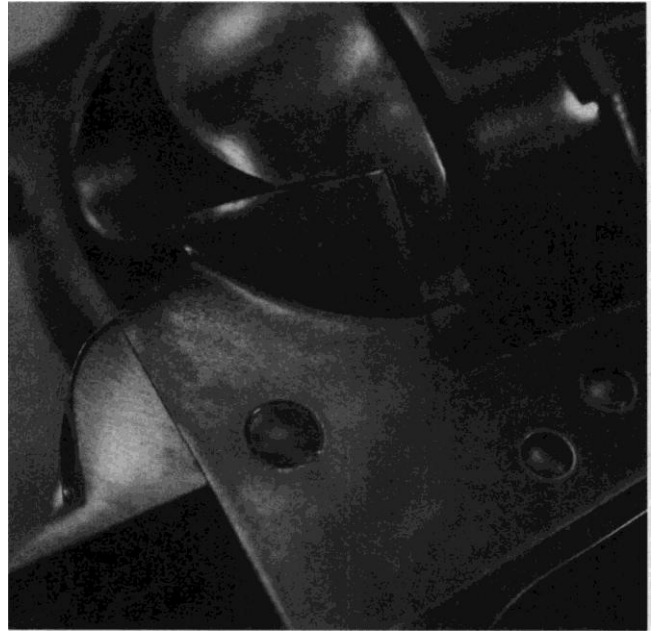
Color case-hardening

In color case-hardening, the finish most commonly found on the frames of Colt single-action revolvers, the “color” is actually a by-product of attempts to harden the steel. While the malleable iron or mild steel available in the 19th Century was easy to machine, it was not as durable as the manufacturers wanted. They decided to try to harden it.

The process starts by packing the bare frames in a carbon-containing medium, usually bone meal, and heating them in ovens to 1400° for 2 to 4 hours. The temperature drives carbon from the bone meal into the surface of the iron or steel. To stop the heating, the frames are quenched in clean, soft water, agitated by bubbles, which fixes the carbon in the surface. The colors that result can be very attractive. Unfortunately, the hardness is only .005-inch thick. Longer soaking times in the oven, or higher temperatures, drive the carbon deeper into the surface. The color, however, rapidly diminishes as the carbon penetrates deeper.

Nobody uses this process any more. The heat-and-water-quench warps too many parts, making the process too expensive.

Like many Colt SA revolvers, the Ruger Vaquero is available in a color finish. The alloys Ruger uses in their revolvers don’t need to be case-hardened, and wouldn’t change color even if you tried. Ruger’s color finish, a trade secret, is a the result of a chemical reaction, vaguely similar to hot-dip bluing.



Color case-hardening is an old method of both protecting the surface and hardening the iron. While attractive, it doesn’t do either very well.

Parkerizing

The process of phosphate coating in use since the late 1800’s found itself refined around 1910 and trade-named Parkerizing. Later, the trade name came into common usage to describe the general process. Parkerizing is a very durable finish that is not very appealing to civilian hunters and sportsmen.

The firearm is first dipped in a cleansing, mild acid bath. Once clean, the parts are immersed in a boiling solution of phosphoric acid containing iron and either zinc- or manganese-phosphate. Depending on the particular steel and the precise solution, the surface reacts to form either manganese phosphate or zinc phosphate. The color of the final finish is dark gray. The manganese phosphate is a heavier and more durable finish than the zinc.

Because a rough surface is larger than a smooth one, and provides more area with which the phosphate can react, Parkerizing is best done to a surface that has been bead-blasted or brushed with a coarse wire wheel. After Parkerizing, a firearm is even rougher than it was going into the tanks as any previous polishing gets matted both when the steel is dipped in acid and during the Parkerizing process itself. A tightly-fitted pistol may require re-lapping the slide and frame until they slide smoothly.

The newly rough surface traps and holds oil, and an oiled Parkerized surface is very rust resistant. Unfortunately, it is just not pretty enough for some hunters and sportsmen. Now that the military is using aluminum instead of steel in their rifles, they no longer Parkerize.

In an effort to cut costs and increase durability, many manufacturers offer an alternative: lower-cost models of firearms with an even less-polished, but still Parkerized finish. Some shooters do not like the much-rougher surface, and others are happy with the lower cost.

Nickel

Near the end of the 19th century, nickel began showing up as a protective finish. First available in mirror-bright, and later in brushed or bead-blasted, nickel finishes did offer protection from corrosion.

The first nickeling processes involved a tank full of nickel dissolved in metallic cyanide salts. The parts to be plated were suspended at one end of the tank, while at the other was a sacrificial bar of nickel. An electrical current was pumped into the tank. The current removed nickel atoms from the bar and deposited them on the parts.

Pistols so treated soon became the hallmark of the Mexican bandito and the low-class criminal in big cities, handicapping nickel finishes from wider acceptance elsewhere. One simply didn’t do that sort of thing to one’s firearm if one had any taste at all. The only way to have a handgun nickeled and maintain social status was to have it engraved and then nickeled.

Electrolytic nickel plating is a complicated and costly process, involving electricity, expensive chemicals, and the expensive disposal of those chemicals when exhausted. A firearm that isn't plated properly will easily chip or flake. Firearms manufacturers gradually phased out nickel, replacing the finish with stainless steel.

Because some shooter desire a shiny finish, nickel is available from refinishing shops. Even properly done, electrolytic nickel can peel and crack away from the underlying steel. The finish is also susceptible to the old formula of Hoppes #9; long-term soaking in it sometimes caused flaking. Even though new formula Hoppes does not cause flaking, the finish still cracks, and flakes, anyway.

The social stigma of shiny guns has faded a great deal in the last couple of decades. The advent of stainless first made a white handgun acceptable. Now, extremely durable finishes such as hard chrome (see below) are accepted and not exceptional. For about the same cost as electrolytic nickel these new finishes leave the handgun both bright and protected.



Hard chrome is a white plating that shows the texture of the surface finish. This is Enduraguard from Accurate Plating, and they did a very nice job of bead-blasting the surface before plating it.



This is a Smith & Wesson 25-2, .45ACP revolver that was plated by Accurate Plating. Powder residue wipes off, and the surface shows no wear even after many practice sessions and thousands of rounds of hot bowling pin ammunition.

Hard Chrome

Using the same metal as decorative chrome, hard chrome (or “industrial hard chrome”) was developed to plate the cutting edges of milling and drilling tools, affording them longer life in industrial applications. At first, the large, very hard steel parts became brittle during their rather long plating process. “Hydrogen embrittlement,” which was never much of a concern for the much softer steel and much thinner plating needs of handguns, has been solved both for the machine tool industry and firearms plating.

When hard chroming had grown common enough, in the mid- to late 1970's, shooters started treating their handguns. Hard chrome, a bright white plating with a thickness of less than .001-inch, commonly .0004-inch, is very stark. It will not hide anything. Any flaw you have left behind in preparing the surface will jump right out.

The surface hardness of hard chrome is between 65 and 70 on the Rockwell C scale, much harder than the approximately 30 of a handgun's frame and the 40 of its slide. The bond is so good that a blow hard enough to dent the underlying steel does not break the chrome away. Properly done, hard chrome will not crack, chip or flake. To remove it your refinisher must use an acid bath.

Hard chrome also has a very low coefficient of friction, and two chromed surfaces sliding on each other rub less than two steel pieces do. The harder surface and decreased friction greatly increase the service life of any moving parts.

In many regards hard chrome comes very close to being an ideal firearms finish. Although it is not the ultimate in corrosion resistance, (steel will rust through, though very slowly), it is very popular with competitors whose firearms see a lot of use.

Here in the Detroit area, we occasionally see old handguns that we call “bumper chrome” guns. With so many auto plants in the area, all making chrome-plated bumpers, it was not a big deal for one worker to ask a couple of his buddies to chrome the occasional pistol. Stripped, degreased, and dipped in hydrochloric acid to remove the blue, the parts were dropped into the moving tanks of bumpers and fished out at the other end by another fellow auto worker. Bumper chrome, applied to firearms, is not very durable. It flakes easily. The typical lack of polishing leaves a shiny but rough finish, and the fish-belly white color to the plating is not only a dead giveaway to the origin of the finish, it's pretty unattractive, too. If you don't live near an auto plant, you'll probably never see this “finish.”

With the advent of hard chrome, and more and more stainless steel handguns available, interest in developing new handgun finishes surged in the late 70's and early 80's. Since then a number of processes have emerged. All offer advantages and disadvantages. The perfect firearms finish has not yet been developed.

Armoloy

In addition to electroless nickel plating and industrial hard chrome, the Armoloy company offers a specialized application of chrome. Called Armoloy, it is a nodular thin dense chrome application. The thickness applied is .0002-inches! As with all hard chrome, it is hard stuff, 70 on the Rockwell C scale. (A file measures in the low 60's.) The plating is a slightly darker gray than regular hard chrome, resists salt and acids, and is a snap to clean up. You can plate any kind of steel, carbon or stainless. You should not put Armoloy on springs, and they will not plate aluminum or plastic. Armoloy is a plating company, and does not offer any pistolsmithing services. You must ship your handgun completely disassembled, with a list of the parts.



This Armoloy finish shows all the markings, good or bad. The caliber designation is needed, and the small dimple is a reminder. Both stayed, and both show.



Armoloy does not have a gunsmith on the premises, you must ship your handgun to them completely disassembled. It will come back the same way.



Rambear Enterprises makes a teflon-kevlar finish called Bearskin. You can have it in a spectrum of colors, and even applied in a camo finish.



The Bearskin finish on this Gunsite ATP 1911 shows all the markings, and does not dull the forward grasping grooves.

Teflon

Teflon started appearing on handguns in the 1970's. Just like the early teflon frying pans, the first teflon-plated guns weren't very durable. A few months of daily carry in a holster could wear the teflon right through, exposing the steel underneath. The finish tended to fade. The process has improved greatly in the years since.

Accurate Plating can put a teflon finish right over electrolytic nickel. Called "Ebony T," because of its black color, the finish does show wear. For greater durability of the underlying plating, Accurate can first do an electroless nickel finish, then the Ebony T. Not surprisingly, this process is 50% more expensive.

Rambear Enterprises also offers a teflon finish, called Bearskin, which can be applied over other platings, aluminum, steel and stainless steel. They use a kevlar binder to increase the durability of the teflon, without decreasing its resistance to chemicals and solvents. Bearskin adheres to the base metal much better than previous teflon finishes. I took a test disk of sheet metal coated with Bearskin, and bent it in half. The Bearskin did not flake off at the bend.

Bearskin also acts as a lubricant. Pistols treated with it do not need lubrication. If you want to lube you can.

A teflon finish can be used in applications where other finishes won't work. A revolver with an aluminum frame, for example, cannot be otherwise plated. Solutions to plate the aluminum will attack the steel pivot pins of the hammer and trigger, as well as the steel barrel and cylinder. Solutions to plate the steel will dissolve the aluminum frame. Before teflon, plating a gun like this required prying the steel parts out, and reinstalling them later. Now teflon, applied with an airbrush, protects the revolver— with much less disassembly required. As a bonus you can have a camouflage pattern brushed on. They can probably sign your name, as well.

If you are going to have a revolver teflon coated, do not have the inside, or any of the interior parts coated. Teflon is applied in a thicker layer than the metal platings, and this can cause problems with tightly-fitted revolver parts. If you send a pistol with a snug slide-frame-rail fit, after the teflon is applied over the rails the pistol may not go back together. You can end up lapping the rails again, until the slide moves freely. You'll scrub most of your teflon off the rails. I have seen a number of rusted pistols through the years, and the last place they rust is on the rails. By the time that happens, you will definitely notice the rest of the pistol getting shabby.

Electroless nickel

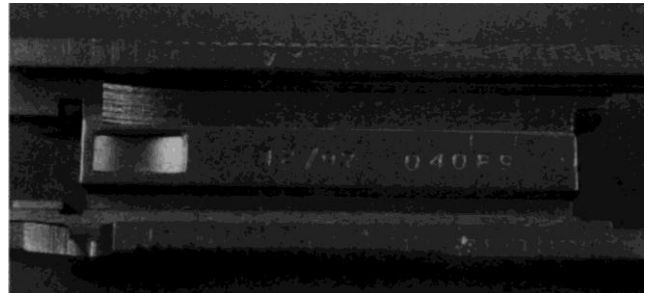
Electroless nickel is a definite improvement over the old nickel process. For one thing, it offers a matte finish, with a slight gold or yellow tinge to it instead of the old bright nickel. A chemical deposit which provides a very uniform plating, electroless nickel starts off as a heated solution containing nickel. When the solution is driven through the proper temperature ranges, the nickel precipitates onto the firearm. While it is not as hard as hard chrome, "only" 53 to 56 Rockwell C, electroless nickel does not build up the slightly thicker deposits on corners and edges that electrically-driven plating processes such as hard chrome can. A properly applied electroless nickel plating will not peel away from the underlying steel, even if the part is bent through 180 degrees. There is even a government test for this, MIL-C-26074A. And you wondered where your tax dollars went.

Electroless and Teflon

As icing on the cake, the Robar company developed a process that combines electroless nickel with teflon. Called NP3, the electroless nickel solution incorporates sub-micron particles of teflon throughout the plating. If the nickel wears, fresh teflon-bearing surface is exposed. The plating is extremely even, and only .0002-inch thick. It is slightly less hard than straight electroless nickel, measuring 48-51 on the Rockwell C scale.



This 1911 came back from Robar in protective layers of plastic wrapping film. If it gets scratched, it won't happen at Robar, or coming back from Robar.



The NP3 finish from Robar is an electroless nickel that incorporates teflon in the plating. It is less than .001 -inches thick, and clearly shows the markings on the bottom of this slide.

The finish is a silver-gray and shows the texture of the base metal. If you have the surface of your handgun sandblasted, you will end up with a dark gray finish. A curious aspect of NP3 is that if you scratch the surface down to the bare steel, any rust that forms does not seem to spread under the edges of the plating that remains. If we could get it to grow back, then we'd really have something!

Because of the teflon trapped in the nickel, NP3 has a very high lubricity, and the friction between parts is just about as low as you can get. NP3 is a very popular finish for desert applications. Because of the low friction, you don't really have to oil the parts. Without oil to attract and hold the grit of the desert, the NP3 actually lasts longer dry than it would oiled. For non-desert uses, I still oil NP3. The combination of a light film of oil and the natural lubricity of the NP3 makes cleaning up a simple wipe-clean operation.

Stainless steel blackening

Robar also offers a blackening process for stainless steel. The chrome already in the stainless alloy is oxidized in a chemical treatment solution, resulting in a Chrome-sulfide surface. Since the surface is not plated, the dimensions of parts are not changed. While not changing the heat-treatment or durability of the steel, the process does increase resistance to corrosion.

Stainless steel blackening depends on the treatment plant knowing the alloy being treated. Robar has a chemistry lab right on site. If you ship them something they haven't seen before they can test it before treating it. If you want to send your stainless handgun to someone else for blackening, ask if they have treated that model before you ship it.

Black chrome

Back in the 1980's, black chrome was thought to be the next, great leap forward in firearms finishes. With a black chrome finish, it was thought, shooters could have the durability of hard chrome and the black color of bluing. Unfortunately, black chrome is not very durable. Accurate Plating applies it over a base coat of nickel or electroless nickel to increase durability and adhesion. It does not reach into the internal spaces of a handgun, so the magazine well of a pistol may not be fully blackened.

While the jet-black finish is quite attractive for the same durability, at a lower cost, and the ability to patch-repair the finish, you are better off with a baked-on epoxy.

Gold plating

Flashy, expensive, and very soft, gold plating offers no durability. In very expensive custom firearms, gold can be inlaid into the surface of the steel. As inlaid wire gold is slightly more durable. The most frequent use for gold plating is on small parts of a presentation handgun, to accentuate the bluing of the frame, slide, barrel, cylinder, or other larger parts.



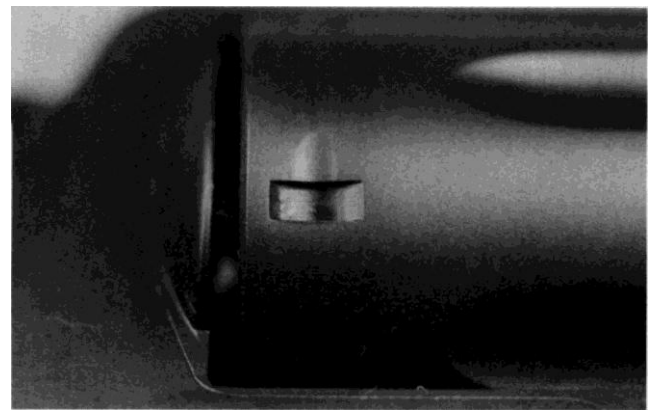
Back from Robar, this 1911 was covered with Roguard. It is a semi-gloss black that promises great durability, and is curiously soft to the touch.



The Roguard finish reproduces the serial number stamped on this mainspring housing, as well as the stippling.



The Enduracoat faithfully reproduces all the markings on this M-65.



This is a S&W M-65 in .357 Magnum. Coated with Accurate Platings Enduracoat, this locking notch shows no chipping or wear after 2,000 times of dry-firing.

Baked-on finishes

Paint as a metal protectant has been common for the last couple of centuries. In the early attempts, the paint quality was so poor that a painted metal surface wasn't really protected. Maintaining the paint was more work than maintaining the metal.

While modern paints are far more effective, they are still not durable. Epoxies provide the needed durability. A reaction between two or more chemicals, epoxy forms a tough and lasting coating. The epoxy finish for a handgun doesn't fade, and is very scratch and chip resistant. Paint dries, epoxy reacts. Epoxy, unfortunately, also costs. And it has the same large choice of colors that Henry Ford offered his early customers: Black.

One of the best epoxy finishes for your handgun is Roguard, from Robar. Robar is so confident of Roguard's ability to resist peeling and corrosion that they offer a lifetime warranty on it. If Roguard peels, or if your firearm corrodes through the finish, Robar will replace the finish. Obviously, tire tracks and hammer marks would negate the warranty on the parts of your handgun so marred.

Roguard goes on in a layer only .001-inch thick, so you do not lose any of your markings. Any mars and blemishes will likewise be sealed in but not covered up if you do not first prepare the surface and remove them. Roguard can be patched, unlike the other platings already discussed. If you do wear the high spots of your handgun down to the bare metal, you can ship it back to Robar for a touch-up session.

Accurate Plating also does a baked-on epoxy finish, called Enduracoat. When I was testing various finishes, I discovered an interesting thing about Roguard and Enduracoat: their feel. The finishes are smooth without being slick, and they feel soft. Not spongy-soft, but just soft enough to take the hard touch from the base metal. When I first pulled the handguns with these coatings from their shipping packages, I could hardly put them down!

Anodizing

"Airweight" handguns have frames made of aluminum alloys. Aluminum can be finished with electro- and electroless nickel, hard chrome, teflon and any of the epoxy finishes. The caustic solutions of a hot-dip blue, intended to work on steel, will dissolve aluminum. Do not rust, heat or caustic blue a firearm with aluminum parts.

The factory anodizes the aluminum to finish it. A heat and chemical treatment of the surface, anodizing forms a hardened skin out of the surface layer of the metal. Properly done, anodizing is amazingly hard. If you have to file anodized aluminum, you'll find your file sliding off the surface until you bear down and scuff through it. Bear in mind that the aluminum scope rings used for rifles are not anodize-hardened, just blackened.

Depending on the dye used near the end of the process, you can have aluminum anodized a whole series of colors, including the ever-popular black. Over time and under use, however, anodizing will fade. The black dyes commonly used turn a bluish or purple color. Sweat and wear will leave the front and back of the frame of a well-used Colt Lightweight Commander significantly lighter in color than the rest of the firearm.

An aluminum frame being re-anodized must have all of the steel parts removed, or they will contaminate the chemical solutions used. If you have to repair an aluminum revolver frame, you have two choices for a new finish. One, send it back to the manufacturer. They can properly remove the steel parts without damaging the frame, re-anodize it and reassemble it. Two, use some other finish that is compatible with both steel and aluminum.

Re-anodizing a 1911 aluminum frame is easy. Pull the grip screw bushings and the plunger tube off, get the frame re-anodized, and then reinstall the bushings and tube.

Factory available finishes

In many cases, the choice of finishes available from the factory is pretty limited. Hot-dip blue or stainless steel are generally offered. Sometimes you can get a mix, such as a blued slide and a stainless frame. Some manufacturers will electroless nickel parts on a stainless handgun to match the finish. You cannot ask the manufacturers to hard-chrome or electroless nickel a handgun before they ship it to you.

Glock

When Glocks appeared, they brought with them a new, uncommonly hard finish. Called Tenifer, the finish made the surface of Glock slide so hard it would resist a file. Tenifer is not a plating, but a treatment of the surface of the steel for hardness and corrosion resistance. At Rockwell C 69 or 70, you need to use a carbide drill or end mill to do any major metal removal. Use a diamond file on a Glock slide; it's the only thing that will stand up to the Tenifer.

Glock only offers a black finish. The black is an oxide coating applied over the Tenifer for aesthetics. Buff off the black, and the underlying steel will still be protected by the Tenifer. Buffing a Glock slide and then plating it with hard chrome or electroless nickel is gilding the lily. You will be plating the steel with a layer that is slightly softer than the steel itself, and will add only the smallest extra measure of corrosion resistance.

Sig Sauer

As a factory option, Sig offers a polymer finish on their handguns. This baked-on epoxy coating reduces friction and adds corrosion resistance.

The bulk of Sig pistols are shipped with black oxide steel parts and hard-anodized aluminum frames. Occasionally the factory releases a batch done in hard chrome or electroless nickel, but this happens without any fanfare or warning. Miss the batch, and you have to wait until the next one.

Smith & Wesson

Smith offers the widest line of stainless steel pistols and revolvers. When the popularity of stainless rose in the early 1990's, Smith dropped their nickel finish. Between the environmental regulations, and nickel's declining sales, Smith could no longer justify the costs for nickel plating on a production basis. You can still have a nickeled Smith & Wesson re-finished in nickel, but you cannot get a new one.

Smith offers some two-tone models, with black oxide slides and stainless frames. They do not offer hard chrome.

The rest of the handgun manufacturers for the most part offer only blue and stainless. Occasionally you can get your blue or stainless in a high polish, and sometimes even a two-tone blue and stainless mixture is offered. Mostly, though, you don't get a choice, and will end up sending your handgun off to a re-finisher after you have done the modifications you feel are necessary.

What finish should you use?

Base your choice of finish for your handguns on the availability and benefits of each finish, the cost, your expected use, and your own taste. If you just can't stand the thought of a nickel or nickel-like finish on your handguns, then don't let anyone talk you into a decision you will end up hating. In the end, you have to go with what you like.

First, revolvers.

I am somewhat embarrassed to say that my competition revolvers have the original finish on them. That is, where they have a finish. My Smith & Wesson 25-2 in .45 ACP, used for bowling pin shooting, is mostly factory blue. I say "mostly" because in places the bluing is worn off from years of practice and competition. Sooner or later, when the experimentation has stopped, I will have it hard chromed. My International Revolver Confederation competition handgun is a seven-shot Baumannized .357 Magnum. It started life as a blued Smith & Wesson Model 28, and since leaving Springfield it has acquired a stainless S&W model 627 barrel.

My two PPC revolvers are both mixtures. One is a stainless S&W M-66 with a carbon steel barrel that I have never gotten around to bluing, and an Aristocrat rib in blue steel. The other one is a S&W M-27 that was electroless nickeled before I put a stainless barrel and a Powers rib on it. The previous owner had gold-plated the hammer and trigger. Not for me! I replaced the gold with a Cylinder & Slide hard-chromed roller-action hammer and trigger.

Starting over, I would build a PPC revolver on a stainless frame and fit a stainless barrel to it. The rib would be an Aristocrat or Powers rib made of blued steel. For bowling pin competition, I would use a S&W 625-2, again in stainless steel. I would fit it with a stainless barrel and a blued rib. In these applications the finish doesn't matter. Any money spent should be spent on improving performance.

If I were starting from scratch for a hunting revolver, just like the competition revolvers I would start with stainless steel. However, once I had done all the custom work that I needed, I would send it off to Accurate Plating, or The Robar Companies, and have the stainless blackened. While hunting, the flash or gleam of a polished, or stainless steel revolver can startle the game.

For cowboy action I would stick with tradition—a case-hardened and blue finish. Yes, hard-chroming makes it easier to clean, and improves its long-term durability, but, heck, it's just not right. I will confess to owning at least one bright-nickel-plated single-action revolver. In my own defense, I won it at a match and was not offered a choice of finish. I know I could have traded it for one more suited to my tastes, but I do not trade or sell guns I have won. I know, I know. It's a failing on my part, but, except for duplicates, I just can't bear to part with prizes.

Call me old-fashioned, or conservative, but for a single-action revolver I think that a mixture of bluing and color case-hardening is the only appropriate finish. I also think the earliest T-birds are the most attractive cars ever made.



For daily concealed carry for personal defense I would select a stainless revolver and have it blackened. Blackening affords an extra measure of corrosion resistance, and makes the handgun less obvious.

My preference on pistols is to leave many of them “in the white,” that is, stainless or plated. For practical shooting, or a competition handgun that will fire many thousands of rounds, both service life and ease of cleaning are important. After finalizing the custom work, I would go with an NP3, hard chrome, or electroless nickel coating. Any of these finishes makes cleaning up easier, and increases service life. I would leave the sights black. Thinking of shooting in the National Matches at Camp Perry? The social imperative here seems to be for a blued or black pistol. Hardly anyone shoots a hard-chromed handgun. Not that the rules forbid it, but who wants to stand out too much?

In the case of building a pistol for Bull’s eye, I would be sorely tempted to have the pistol plated for longevity, and then have the exterior black epoxied. Or even black paint.

An all-steel pistol for daily concealed carry could use any one of several strategies. Your goal should be to improve corrosion resistance without drawing attention to the firearm. You could start with a coating of NP3, hard chrome or electroless nickel followed by either the Brownells bake-on lacquer finish in black, or Roguard. Another approach is to nickel plate the firearm and have Accurate Plating give it an Ebony T coating. Or, for the best combination, try a hard chrome or electroless nickel covered with the Rambear Bearskin. You could even NP3 plate your handgun, then Bearskin coat it, to build up two layers of teflon protection.

All of this is expensive. The pistol, the custom work, the two finish jobs—it adds up. But you could wear the pistol all day, depend on it 100%, and know that rust would never attack it. Your only maintenance problems would be brushing out any dust bunnies and swapping ammunition on a regular basis.

A less expensive method of protecting your concealed carry pistol is to take the Brownells route for both layers of protection. First, Amer-lene black and Parkerize the surface. Then, use a baked-on finish to further seal it away from corrosion.

A carry pistol with an aluminum frame would get the steel parts plated, and then the whole thing would be Roguarded, Bearskin or covered with bake-on epoxy.

Exceptions to all the above? A Glock, which needs no extra finish at all.

Preparing your handgun for the plater

First, consider how much work you want to do yourself to prepare the surface. The process of plating is exactly like the process of painting a car. If you turn your car over to the paint shop with dirt, bugs and scratches on the surface, you’ll either get back a paint job with dirt, bugs and scratches under it, or a bill for the labor to clean the surface before painting. If you don’t care that tool marks, casting lines and scratches will show through the plating on your pistol, fine. Your plater, though, may have a different idea.

Some platers are so concerned with their work, and the image of their plating, that they insist on polishing out the more egregious marks. They’ll charge you for that work, too. Do your homework. Get catalogs. Along with the request for a catalog, find out their shop policies. Do they insist on polishing out “ugly” guns? If so, find out the rate, and the average charge. Armed with policies, rates, etc, you can make an informed decision about polishing before you ship. For a discussion of polishing, review Chapter 6.

You will see many handguns with a matte or brushed finish under their plating jobs, but not many with a mirror finish. Why? There are three reasons. First, the acids used to clean the parts prior to immersion in the plating tanks will slightly etch the surface. Even the brightest mirror finish will lose some of its luster. Second, the plating will adhere better to a rougher surface. To reduce the possibility of the finish lifting, platers prefer a matte or brushed surface. Third, a mirror polish is not easy to do. It takes skill, practice, and time—in other words, money. Rather than charge twice as much money, (and not make twice as much) the plater might just say “no” to a mirror finish.

Ask if they want the handgun in pieces.

If you are plating the whole thing and the plater can disassemble it, ship the handgun assembled. This is the best way to ensure all the parts are there. If you are only having parts of the handgun plated, or you are polishing before you ship, disassemble the handgun first.



A good reason to mark your parts before shipping them. Eight trays, eight handguns, eight different states of the union. You want to get your parts back.

While you have the handgun apart, mark the major parts with your serial number. In case a tray of parts gets knocked over at the plater, there'll be no problem figuring out what parts go with your handgun. On a revolver this is not a big deal, as the major parts already have either the serial number or the factory assembly number on them. On a pistol, I mark the parts to be shipped with the last three digits of the serial number, using a set of punches I keep in a drawer for just this task. An electric marking pencil does the same thing.

Separate the objects that won't, or can't, be plated.

Platers simply won't plate plastic parts, such as the mainspring housing on a 1991A1. The older Colt pistols had steel or aluminum mainspring housings. If you want your 1991A1 to have an un-plated plastic mainspring housing, while the rest of the pistol is plated, fine. If you want the handgun to match all over, you will have to fit a steel mainspring housing before you ship the pistol.

Platers will not plate springs. Even if the spring survives the cleaning acid bath, and the plating process does not change the compression qualities of the spring steel, the extra layer of the plating can bind the spring.

Platers do not plate titanium or tungsten. If you send your pistol assembled, note what parts are titanium or tungsten. If you are shipping it in pieces, leave those parts out.

Unless you want your sights plated, take them off. A staked front sight can be masked by the plater before plating, but there is a better way. Have him plate the front sight. When you get it back, use a paint or epoxy to blacken it. For a three-dot set of sights, blacken the sight, then paint the dot back in. Or, remove the front sight and stake a replacement back on when the pistol gets back. If your front sight is in a dovetail, like the Novak sight, remove it before shipping the pistol. The rear sight should always be removed.

None of the radioactive night sights will survive the plating process. If you do not remove them, the plater must remove or mask them, and charge you for the extra work.

Write up a detailed list of all the parts being shipped. Everything goes on this list. Note parts that have been removed: "Sights removed, missing recoil spring guide rod," etc. Total the number of parts on the list, and count the number being shipped. If the plater receives a package, and there are not enough parts for a complete pistol, they have a puzzle. Without your note, they have a problem. You will receive a phone call, asking if all the parts you wanted plated are there, and is there a fax number they can call to send a detailed list of what you shipped? You will be charged for the time and phone call. Save the time and money. Send a list.

Type a letter detailing what level of polish and what finish you want. Keep it simple. As an example; "Enclosed, please find Colt Series 70 pistol #123, caliber .45 ACP, assembled, sans sights. Two magazines, assembled. Please wire brush the surface and hard chrome all parts of pistol and magazines, excluding springs. Check enclosed. Ship UPS Next Day when finished."

In the letter, specify which parts are soldered, and what solder was used. Solder is softer than steel, and can be eroded by bead-blasting, or wiped out of the edge of a joint by a wire wheel. Some acids can attack solder. By telling the plater which parts are soldered you let them exercise due caution when stripping those parts.

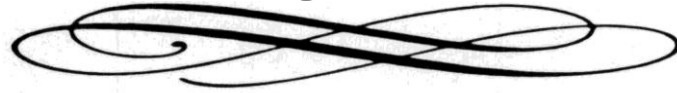
You will rarely want to have the exterior of a pistol barrel plated. Instead, spend your money on a stainless match barrel. You'll gain accuracy and corrosion resistance.

For liability reasons, the plater will not plate the interior of the barrel. Your barrel was manufactured to a precise interior dimension. Plating thick enough to be durable in the bore would change those dimensions, increasing pressure. Plating thin enough to prevent pressure rises would not be durable. The chrome-lined barrels you read about for military rifles? The thickness of that plating is several times greater than the plating on your handgun. The barrel maker took into account the thickness of the chrome plating when broaching and rifling the barrel.

Tell the plater how tightly the slide and frame fit. If you have made the fit so tight they cannot plate it and get the slide back on the frame, they will call you. Do you want them to lap the fit before or after the plating goes on? Or will you re-fit the slide and frame after the pistol comes back?

Once your package returns, open and count the parts. The same number you shipped? Great. Assemble, and have fun. If not, call immediately.

Diagnostic



Chapter 10 - Malfunctions of the Revolver

What is a malfunction? Defined broadly, a malfunction is what happens when you were expecting something else instead. You could call a miss a malfunction, though it's more a malfunction of your own personal mechanism than of the revolver's. And calling your miss "A malfunction of the optical/mechanical sighting system" will not help your standing at the gun club, or bring down that deer happily sprinting away.

As firearms instructor and authority John Farnam remarked in his book *The Farnum Method of Defensive Handgunning*, "The most common stoppage encountered in the revolver... [and] in the autoloaders is running out of ammunition." This wide casting of the malfunction net can give a focus to your panicked attempts at correction. When the handgun stops working, by definition a difficult situation, the first thing to ask yourself is: "Do I have ammunition left?"

We will only cover mechanical malfunctions here, and leave the zen of hitting and missing for later books.

Most mechanical malfunctions are caused by lack of maintenance. If you keep your revolver clean (see Chapter 6) you won't have too many problems. When you do have a problem, though, you will be in one of two situations. The first is the calm, collected and unstressed atmosphere of the shooting range or gun club. There is no need to hurry. Your target won't escape, or worse yet, turn around and attack you. At the range you have plenty of time to figure out exactly what went wrong, and how, and what corrective measures to take.

The second situation is a highly-stressed one. You may be in the middle of a match, with time ticking away, trying to figure out how to correct the problem. Or, you are deer hunting, and all of a sudden the handgun just doesn't want to work. You may not have another chance this season at your quarry. In the worst situation of all, you have attempted to use your handgun in defense of yourself or another, and it won't work. In all of these instances, you have a very limited amount of time in which to take corrective measures, and then continue.

The second situation is actually the simpler, but under stress even the simple becomes difficult. Open the revolver, dump out the rounds that won't work, load fresh ones as quickly as possible, and continue. If new ammunition doesn't solve the problem, drop the revolver and draw your backup.

No backup? Now, you are in trouble. You will need to ferret out the exact cause of the problem, and may not have enough time.

In the first situation, you can take all the time you need to diagnose the problem.

When your car fails to start and you call your mechanic, the first thing he'll do is ask you a barrage of questions: When you turn the key, what noises does it make? Clicking? Whirring? Cranking but not catching? The answers to these questions give him clues about the probable solution; the simple statement that the car won't start provides only the roughest idea of what may be wrong. With your revolver, you are the mechanic. You will have to ask yourself the questions, and then supply the answers.

If, for example, the round won't chamber, you must ask yourself why. What, exactly, is happening to prevent chambering? Or if the revolver fails to fire, what is it doing, and what isn't it doing? Don't immediately jump into fixing the problem. Study the symptoms first. If you hastily assume a particular problem is the culprit, and make a quick fix, you may be setting yourself up for greater problems in the future. Use Chapter 4, *Functioning*, as a guide to troubleshooting.

With your non-functioning car, a quick assumption could send you off to buy a new battery, only to find you have a nasty short in your electrical system. Likewise, if you make a quick assumption about your revolver's malfunction, you could end up fixing it two or three times, and, just like your car, paying each time for the right or wrong solution.

Chamber

When a round fails to chamber, it does not seat completely. Ask yourself why a round would fail to chamber.

First, did you load the correct ammunition? At first glance, the rounds may be so similar that you mistakenly picked up a wrong one. A single .357 magnum in a box of loose .38 Specials will go unnoticed until you try to chamber it. Then it will stop, sticking .10-inch out of the cylinder. Likewise with .44 Magnum ammunition and a .44 Special revolver.

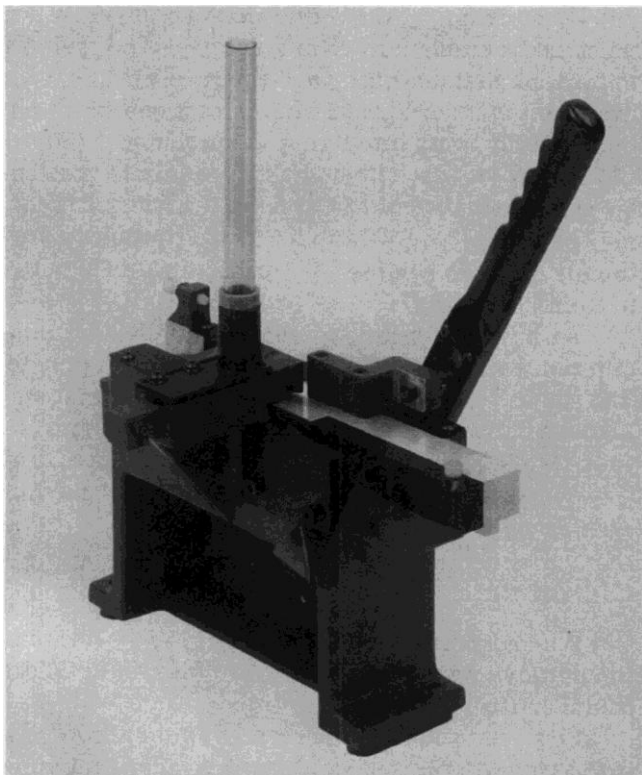
Second, are you using reloads? If so, were they correctly re-sized? The sizing ring of a re-sizing die cannot reach all the way down to the rim of a cartridge, so if you use stray brass picked up at the range you may run into a chambering problem. The previous owner of the brass could have had a larger chamber, or a larger sizing die. He might have fired much hotter loads than the brass could stand, bulging the bottom of the case where your sizing die can't reach. The result will be an incompletely chambered round. The long-term solution to this problem is to use the Case-Pro 100 from Image Industries to iron the case down to size all the way down to the rim. For now, you will have to set the round aside. It cannot be used.

Competition shooters will chamber-check every round before a match, to prevent precisely this problem.

Third, is the chamber clean? Dirt in the chamber will keep the rounds from going all the way home. If you haven't cleaned your revolver lately, or have fired many rounds since the last cleaning (even if it was only yesterday), the chamber may be so gunked up with powder residue that the rounds can't drop in. A temporary fix is to push the stuck round in place with your thumb, but the real solution is more frequent cleaning.

If you have put fewer than 100 rounds through your revolver since the last cleaning and it is already having trouble chambering, you may have undersized chambers. An undersized chamber is already a tight fit; with just a little powder residue you can have a problem. To correct it you need purchase a chambering reamer, open the chambers up to the average range for your caliber, and polish the chambers again. Between doing the job yourself and having a gunsmith do it is a toss-up. The cost of the reamer will probably be close to, maybe a little more than, the labor of having a professional do it. And unless you expect to run into this same problem again, in the very same caliber, you'll never need the reamer again.

Fourth, are there any nicks or burrs on the edge of the chambers? Nicks and burrs, more common on used revolvers, can bind a cartridge and prevent it from fully sliding into the chamber. Burrs and nicks should be stoned out with an extra fine synthetic round stone.



Abused or damaged cases can be rolled to the proper dimension with the Case-Pro from Image Industries, (photo courtesy Image Industries)



Powder residue or un-burnt flakes of powder under the extractor star will keep the cylinder from closing. Brush them out to close the cylinder.

Close

If the cartridges appear to have seated fully, check to see if the cylinder is closing. Don't bang on the cylinder, or force it closed.

If the cylinder fails to lock into place, start with a check for dirt. First look under the extractor star. Revolvers commonly end up with flakes of un-burnt powder and powder residue here. This gunk pushes the extractor star out from its seat by a few thousandths of an inch, and makes the cylinder assembly too long to fit into the frame. If this is your problem, remove the rounds, push the ejector rod to lift the extractor star, and brush the back of the extractor star and the cylinder clean.

You may wonder how those flakes got there. Occasionally, when an empty case is being extracted, powder residue and powder flakes will drop out. If the flakes fall at just the right moment, they can land between the extractor and the cylinder. Ironically, you can also cause this condition when cleaning the cylinder. If your chamber brush fits so tightly that when you pull it out it lifts the extractor star, the gunk the brush removed will end up between the extractor and the cylinder. Don't stop cleaning your revolver! Instead, when you finish brushing out the chambers, hold the extractor open and brush behind the extractor, too.

If the extractor star is not the problem check the front of the frame where the crane fits when closed. A buildup of powder here can also keep the cylinder from closing. Scrub it out. Check the back of the barrel. If you have allowed powder residue to build up on the back of the barrel it can bind on the cylinder face. The powder residue on both the back of the barrel and the front of the cylinder will be crusty and burnished from the action of the cylinder. Scrub both areas clean.

If residues and buildups are not your problem, the next likely cause is reloaded ammunition. Check your cases. Look for one with a very minor bulge — not enough to keep from chambering, just enough to keep the cylinder from closing. A nicked rim will also keep the cartridge from fully seating. If your top round is the nicked one, you won't be able to close the cylinder. Similarly, a high primer will prevent the cylinder from closing. You'll have to be more critical in your reloading, and use the Case-Pro to iron your cases and their rims smooth and even.

You've checked for residue, and you're shooting factory ammunition, or perfect reloads. What next? Try closing the cylinder without any ammunition in it. If the cylinder closes but won't latch, press the cylinder with one or both thumbs. If it latches with a click, your crane is out of alignment.

The most common cause of crane mis-alignment is watching too many movies. The hero checks to see if his revolver is loaded, a rare and amazing cinematic moment. He flicks his wrist to the side, opening and closing the cylinder, and — even if he's doing it correctly-putting a lot of stress on the crane. Your repeatedly imitating the hero while on the range, and forcefully flicking the cylinder of your revolver open and closed can bend the crane.

Some of you will be puzzling over my saying "even if he's doing it correctly." You've probably been told never, NEVER, to handle your revolver this way. Well, sometimes you don't have a choice. When practicing one-handed drills for defensive shooting with a revolver the quickest way to close it is with a flick of the wrist. Once the your practice is done you'll probably get to realign your crane.

You'll need a plastic wedge, a plastic-faced mallet, and a crane alignment gauge. Look ahead to Chapter 15, where crane realignment is covered in detail.

Did you just detail strip and clean your revolver? Perhaps you replaced the sideplate screws in the wrong holes. On earlier Smith & Wesson's the front screw is precisely fitted to hold the crane in the frame but let it swing freely. The other two screws are longer and will bind the crane. To check, back that front screw out half a turn. If the crane now moves freely, you need to switch the screws around until you find the short one. The next time you take the revolver apart, be sure to keep the sideplate screws in order, so you don't have to do this again.

Look at the ejector rod. A bent one will bind against the barrel and prevent closing. To check yours for straightness, open the cylinder and remove the ammunition. Hold the revolver in your right hand, braced against a padded vise. Give the cylinder a spin with your left hand. If you see the tip of the ejector rod spinning in a little circle, your rod is bent. The fix is easy only if you have the right tools. With the fixture, straightening the rod is a 10-minute operation (see Chapter 15). Without a Powers centerpin/ejector rod alignment fixture, you are likely to make the problem worse.



It doesn't take too long for a professional pistolsmith to collect a box of damaged, bulged or broken barrels and cylinders. If you want more power than your caliber can deliver, buy a bigger one. If you hot-rod yours you may break something.

Rotate

Failure to rotate follows two paths. In the first, the cylinder binds and won't rotate. In the second, although the cylinder seems to be free from binding, it does not advance when you pull the trigger or cock the hammer.

A revolver that binds and won't rotate is useful only as an oddly-shaped paperweight. To return the handgun to its intended function, check the same things that can keep it from closing. Examine the extractor star for powder residue. Look for a buildup of powder in the crane cutout, and on the back of the barrel and the front of the cylinder. Also inspect the rounds to see if any have high primers. A high primer will stop a cylinder cold.

Look under the cylinder, and see if the cylinder stop (or locking bolt) is disengaging properly. If the cylinder doesn't unlock, it can't turn. An incorrect trigger job can prevent the stop from unlocking. If the trigger or cylinder stop has been altered, you may have to buy new parts to get the revolver running again.

Check crane alignment. A bent crane binds the cylinder unevenly. The cylinder may move at first, stopping only when it rotates against the bent section of the crane.

Open the cylinder. Look at the tip of the centerpin which sticks out of the extractor star. Does it look centered? Push it into the extractor with a drift punch. Does it bind? Now release it. Does it return from the extractor sluggishly? The same wrist-closing and opening that can bend the crane can bend the centerpin. If yours is bent, you must replace it. A new one is inexpensive and easily fitted.

While you have the cylinder open examine the back of the frame opening. The firing pin passes through a hole in the frame and the recoil shield. The edge of this firing pin hole can become burred from dry-firing. If it has, the rims of the cartridges may be catching on this burr, slowing or stopping rotation. Simply stoning the burr down will solve the problem, and it'll be another 10,000 hammer falls before one crops up again. Which is to say, keep up the dry-fire practice. It's good for you.

If the cylinder rotates freely except for one chamber, remove the ammo. Recheck rotation. If removing the ammunition does not correct the problem inspect the cylinder from front to back, checking for each mechanical problem listed above. If all other causes come up negative, the extractor star ratchet may be damaged. Dropping a cylinder on the ratchet can burr or peen one of its studs. You will have to re-time that stud, a simple, but fussy job requiring a modified file. More on this in Chapter 20.

In the second type of rotation failure the hammer and trigger may seem to be working, but although the cylinder does not seem to bind, it simply will not turn. Or, it turns but not far enough to lock up. The hand may not be doing its job. To check a Smith & Wesson, point the (empty) revolver straight down. Try again. If the cylinder now rotates, strip the revolver and make sure you have the hand spring, found in the trigger, properly hooked over the pivot pin of the hand. Without the spring, the hand flops around in its slot and will not push the cylinder. Gravity holds it in place when you point down, but pulls it away when you point up. If the spring is broken a replacement will solve the problem.

Check the sideplate to see that it is tight. Especially on the Colt DA revolvers, the sideplate holds the hand in place. If the sideplate is loose, the hand can drift away from the cylinder, and not fully rotate it.

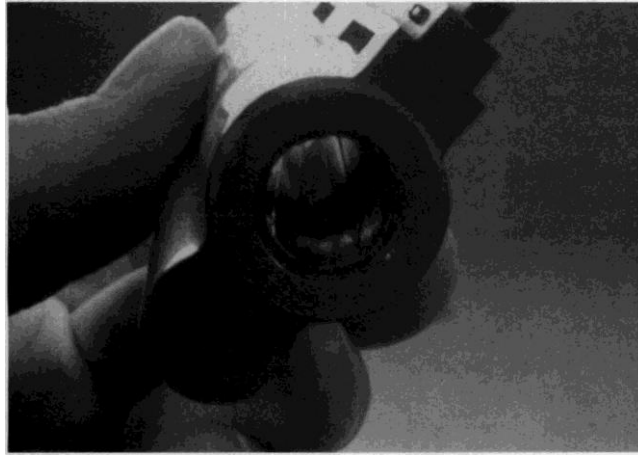
On a used revolver, check the hand. A previous owner may have shortened it during a badly done trigger job. With the sideplate off watch the action as you cock the hammer and see if the hand stops short. Fitting a new hand will take an evening of work, but you may be able to get off easy. If the cylinder only fails to rotate and lockup on one chamber, you're in luck. You can peen the ratchet stud on which the hand fails to carry up, and get the cylinder to lock up.

If the cylinder fails to carry up on several chambers, you will have to fit an over-sized hand. This is also covered in Chapter 20.

One particularly disturbing reason for failure to rotate is a bullet stuck across the cylinder/barrel gap. A poorly reloaded round, usually one with no powder in its case, will still have enough power from its primer to launch the bullet from the case. If the revolver is clean the primer can push the bullet an inch or two into the barrel, allowing the cylinder to rotate with the round stuck in the bore. Fire another bullet behind it and, at the very least, you'll bulge the barrel. A close inspection will reveal the bulge. Hold the revolver up with the barrel pointing towards the light, and look at the shadows running down the barrel. If your barrel looks like a snake with a big snack, it's got a bulge. Or look down the bore. A bulge will look like a dark ring. A bulged barrel rarely stays as accurate as it was before. A large bulge can be dangerous, bursting at some future, unknown moment when fired.



The owner of this S&W saved some money on some cheap reloads. A new barrel will cost many times his "savings."



This ring is right near the muzzle, and the barrel might be salvaged if it is shortened.

To remove the bullet (or bullets), use your range rod to find the location of the bullet's nose. Exercise some caution here, as there may still be loaded rounds in the other chambers. If the measuring shows you that there is only one bullet, you can heave a sigh of relief. Use the range rod and a hammer to pound the bullet back into the cylinder. Open the cylinder and remove the cartridges. Complain vociferously to your reloader.

If there is more than a single bullet in your barrel, you must replace the barrel. Try pounding the bullets back with the range rod, until you come to the joint of the nose of one bullet and the base of another. See if you can open the cylinder. If you cannot, you must cut through the bullet at the cylinder gap. Removing the barrel to open the cylinder will not work very well. Frame wrenches for unscrewing barrels are designed to be used with a revolver that already has the cylinder removed. You can't remove it until you can open it.

Resign yourself to cutting through the bullet. Take a spare blade for an exacto-knife, and with the carbide cutter in your hand-held grinder, serrate the blade. With the serrated blade you can now saw through a lead bullet. While it is tedious, you will eventually open the cylinder, and the blade will not damage the cylinder as a hacksaw blade would.

Cocking

A cocked hammer should stay cocked. If it doesn't, you may have a serious problem.

First check the hammer spur and the grips. A dropped revolver will sometimes fall on the hammer, bending the spur. A bent spur can bind against the frame or grips. Exercise care when straightening a bent spur. Since hammers are usually very hard, if you try to bend the spur back cold it can easily crack and break off. Don't take this risk. Instead, use heat. Clamp the hammer in an unpadded vise, with only the spur sticking out. Use the mass of the vise as a heat sink, to protect the hardness of the rest of the hammer. Heat the spur to cherry red, and with a pair of pliers bend back to shape. Let it cool, and reassemble.

Some shooters cut the spur off. If you are carrying your revolver for defense, you may want to consider this as a way to prevent the hammer spur from catching on clothing when you draw.

If your problem is not in the hammer spur or grips, you'll have to look inside for its source. Strip the revolver and examine the hammer notch. The surface of the hammer notch should be square, even and unaltered. If it isn't, you could have a big problem. Some previous owner may have tried to lighten the trigger pull by stoning the hammer notch. A hammer notch that's been stoned must be replaced. The hammer is surface-hardened, and stoning generally removes the hard layer of steel. If the first stoning hasn't, your corrective stoning certainly will. It should be obvious from this description that you never stone a hammer. If you need a lighter single-action trigger pull (highly unlikely) the place to work is the trigger nose, or single action sear. (See Chapter 20)

If the revolver was dropped when it was cocked, the hammer notch may be chipped or broken. Again, the only solution to a damaged or altered hammer notch is a new hammer. A new hammer will cost 20 percent of the handgun's new cost, the trigger nearly that. If you have to replace both parts, your outlay will be over a third of the cost of a new revolver. The labor will run an additional 20% percent, bringing the expense to over half the cost of a new handgun.

Can you re-fit the parts yourself? On some Smith & Wesson's, yes, with careful and detailed work. If your S&W is a Magnum, .357-.41, or .44, S&W will not sell you parts for it, for fear someone will try to turn something into a .44 Magnum that shouldn't be. They will gladly sell non-magnum parts. Try to get a hammer and trigger from them. If they turn you down, go elsewhere. If you have a Colt "V" mainspring revolver, send it back to the factory. Trying to re-fit the hammer and trigger on one of these could drive the Pope to drink. The Colt coil-spring revolvers are a piece of cake.

If the sear and hammer notch look fine, check elsewhere.

Modern revolvers have internal safeties intended to keep the action from working if the cylinder isn't fully closed and latched. To see if your latch is the problem, open the cylinder. Pull the cylinder release all the way back, forward, or out, whichever way it naturally moves when closing. Try to cock the hammer. Hold the latch closed. Does the hammer cock now? If it does, the latch is gunked up with old oil or powder residue. Clean it.

Smith and Wesson revolvers use a flat spring as the mainspring. If you have backed out the mainspring strain screw to make the trigger pull lighter, you could have caused your problem. When you cock the hammer you should be bending the spring. With the relaxed spring, at a certain point the angle of the spring lines up with the axis of the hammer. You end up compressing the spring. Called “knuckling,” the problem is easy to fix. Just turn the strain screw in a half-turn. The problem goes away. If you still want a very light trigger pull, use another spring. This one won’t cooperate.

Fire

Failure to fire can be very embarrassing. Far worse, it can be very dangerous.

Open the cylinder or the loading gate, and check to see if the revolver is loaded. If it is, unload it and look at the primers of each round. Look for any sign of a firing pin strike. A full indent from the firing pin, but no “bang!” is an ammunition problem. A slight firing pin hit usually means weak springs. If there is no sign at all of a strike the firing pin had better be broken or you’ll have one puzzling problem to solve.

Professional gunsmiths joke about the number of firearms, handguns included, they see with the same problem. As described by the customer, the story goes something like this: “It wouldn’t fire. Must be a broken firing pin.” Sometimes the tale is even accompanied by a lament about the size of the buck that was standing in the open. The firing pin is very rarely the cause of failure to fire. Even so, the first thing the pro checks, and the first thing you should check, is the firing pin. Is it broken? A broken firing pin is pretty obvious: there is part of it missing. Is it bent? A bent firing pin is more subtle, but with close inspection you can tell. A bent firing pin can bind in the clearance hole through the frame. Bent or broken, you have to replace the pin. You can try to straighten a bent one, but if it survives the attempt, it will break soon after. Save yourself the effort and just replace it.

If it is a frame-mounted firing pin, is it binding in its seat? Petrified oil or grease, or Loctite that has flowed into the firing pin hole from some other screw can bind a frame-mounted firing pin. You’ll have to remove the firing pin and its spring from the frame, clean them off and re-install them. Simply hosing oil into the hole will not correct the problem.

Sometimes the firing pin is just too short, the result of a “modification” to gain some unknown improvement. If you just got a great deal on a used revolver that doesn’t fire, check firing pin protrusion. First measure the gap between the recoil shield and the cylinder with feeler gauges. Then dry-fire the revolver and hold the trigger back, to keep the firing pin forward. Use your feeler gauges again to measure the gap between the tip of the firing pin and the cylinder. Deduct the second measure from the first, and you have firing pin protrusion. The firing pin protrusion should be more than .040-inch and less than .050-inch. If someone has shortened the firing pin so the protrusion is less than .040-inch, you will have to replace the firing pin.

Some Smith & Wesson revolvers will not let you measure protrusion so easily. Older Magnum revolvers were made with recessed chambers. Each chamber was reamed with a seat for the rim of the cartridge, leaving the firing pin protruding past the back of the cylinder. To check these, you must use Brownells protrusion gauge. Remove the cylinder. Measure the gauge in its closed position, with the locking screw unlocked. Then, holding the cylinder latch in the closed position, cock and dry-fire the revolver. Hold the trigger back. Position the gauge over the firing pin, which will push the center out. Lock the gauge with the locking nut. The extra length of the gauge over the previous measurement is the protrusion.

More likely than a shortened, broken, or bent firing pin is that someone has decreased the strength of the mainspring. If you’ve noticed light and insufficient firing pin strikes on the primers, check the mainspring. Modified springs as the problem in a mis-firing revolver is so high a probability that after the firing pin, it is the second thing a professional pistolsmith checks.

When modifying a handgun some shooters just jump in, lightening springs until the action “feels good.” What feels good, though, may not “work good.” The strain screw on Smith & Wesson revolvers is a favorite target of unenlightened experimenters. With a turn or two of the screw they can lighten their trigger pull remarkably. But now the screw is not secured. It is loose in the threads and vibration will further unscrew it. The light trigger pull gets steadily, but only very slowly, lighter until the revolver starts misfiring. Tighten the screw. In Chapter 20 you will learn how to smooth and lighten the trigger pull without causing misfires.

Some shooters use a sidecutter to clip a few coils off the mainspring on revolvers with coil mainsprings. Sure enough, the trigger pull gets lighter, and just as sure, the revolver starts misfiring. Replace the cut spring with a new one.

One of the oldest tricks to lightening the trigger pull of the Colt “V” mainspring revolver is to place a small-diameter rod in the “V”, and cock the revolver. Cocking bends the mainspring over the rod and the resulting kink can lessen the force of the spring. If you bend in the wrong spot, however, either you don’t lessen the trigger pull, or you make the spring too light, and have misfires.

A seriously worn revolver can have so much endshake that the firing pin can't reach the primer and strike it hard enough to fire the cartridge. See the buyer's checklist in Chapter 4 for the endshake test. Once you remove this much endshake you'll probably have to set back the barrel as well.

If, when you inspect the rounds for firing pin strikes, you find ones that are heavy enough, but in the wrong spots (say, on the rims of the cartridges), you have a cylinder out of time. It is skipping over the locking bolt, or falling off the hand and failing to carry up. In either of these cases the cylinder will not present the primer correctly for the firing pin. If the cylinder doesn't carry up you will have to adjust the hand. If the cylinder skips you must adjust the locking bolt. See Chapter 20.

Return the trigger

The trigger return spring and rebound block push the trigger back to its resting position. Unlike pistols, revolvers have very clean, crisp, light, single-action trigger pulls, right from the factory. I have rarely seen a revolver that needed improvement in the single-action pull. While you should leave this spring alone, because the trigger return spring (like the mainspring) affects the weight of the single-action trigger pull, it is the subject of a lot of poorly considered experimentation.

A shortened trigger return spring can cause such sluggish trigger return that in double-action shooting your trigger finger may move forward and back so fast the trigger will not be able to reset. The action will lock up tight.

Even a standard-strength factory spring can be overworked if the mechanism is too dirty. Heavy grease or petrified oil, mixed with powder residue, dust, dirt and lint can bind the spring and rebound block. Cold weather can render a dirty revolver completely useless. Clean the gunk out. Use a light oil, preferably a synthetic, and you will not have this problem.

The last source of trigger return failure is heavy-handed reassembly. The stud behind the return block is long enough to fit into the sideplate. Forcing the sideplate during reassembly will bend the stud. The bent stud will bind the block and freeze it in place. This will require a return to the factory.

Open

Look at the front of the ejector rod to see if it has unscrewed. If it has, screw it back in. Once you get the revolver open and unloaded, lock the ejector rod down properly.

The cylinder latch may be binding. On the S&W there is a slot cut into the frame. The cylinder latch moves a bar that rests in this slot. The gap between the bar and the slot provides a large area in which oil can petrify, preventing the latch from moving the bar. Disassemble and clean the bar. Use a synthetic lubricant.

A bent centerpin that makes closing the cylinder hard will also, when you are done shooting, make opening it hard. A centerpin bent from swinging the cylinder open and closed will be difficult to push open and may stay wedged in the extractor star. You will have to replace the centerpin.

If the cylinder latch moves smoothly, but the cylinder won't swing out of the frame, check that pesky crane screw again. On the S&W revolvers, the crane screw is the front one on the sideplate. You may have the screws in the wrong order.

A cylinder that fails to open because of a bullet in the gap has already been covered.

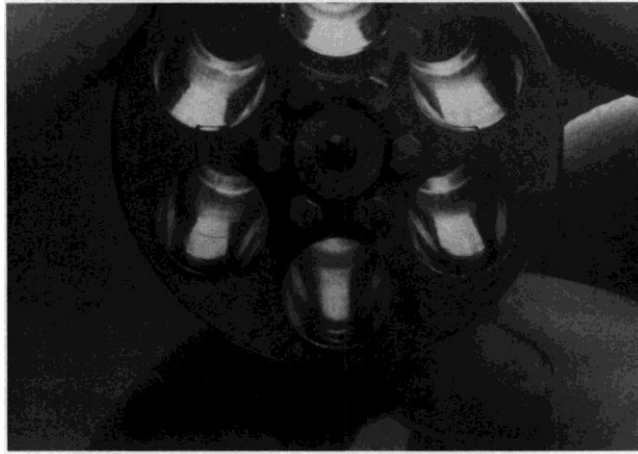
Eject

An empty has failed to eject, and not for the first time. Are your reloads too hot? Most failures to eject stem from a load that is too ambitious. A sufficiently heavy reload can not only make ejecting these empties difficult, it can also make future ejection difficult.

Colt revolvers have their locking slots cut into the side of the cylinder, but slightly offset from the chamber. Revolvers with an odd number of chambers have the slots in between the chambers. On many revolvers the locking slot is directly in line with the chamber.



Cracked or broken cases will prevent your handgun from working properly.



The bottom chamber is bulged, right at the notch for the locking bolt. A hot load that was over-pressure has just cost this shooter a new cylinder.

With these revolvers there is not much steel left between the slot and the chamber. A very heavy load can bulge the steel from the chamber into this slot. Even a small bulge can cause difficult ejection.

The bulge may be so slight it cannot be seen except by an experienced eye. Whether obvious or not, the cure is the same. You must replace the cylinder. A few hundred feet per second increase in the velocity of your reloads will have cost you a third the cost of your revolver. Do not exceed the maximum limits of reloading guides! The upper limit on velocity is there for a reason.

Have you been shooting shorter cases in your revolver, say .38 Specials in a .357 Magnum revolver? As discussed in Chapter 5, in the section on specialized cleaning tools, the shorter cases create a buildup of powder residue and lead particles between the mouth of the case and the front of the chamber. When you switch back to longer cases, your empties may wedge against this buildup, defying ejection. The solution to this problem lies in better cleaning. Reread the pertinent information in Chapter 5.

When the cylinder is open, the ejector rod sticks out with no support, and may become bent if you are not careful. A bent rod may only allow the empties to be pushed partway out of the cylinder before it binds and stops. To see if your ejector rod is bent, brace your hand and give the cylinder a spin. A damaged rod will be obvious. In an emergency, pluck the empties out of the cylinder, put new ones in and push the rounds and ejector star back into the cylinder.

In a non-emergency, unload the revolver and turn it over to a professional pistolsmith. To straighten the rod properly requires an expensive, specially made fixture. You can spend half the cost of your revolver for one, and never use it again. Even a professional pistolsmith may only pull it out of the cabinet a couple of times a year.

One rare reason for failure to eject is the wrong ammunition-rare because there are just a few combinations of calibers that you can mix up and escape with only a funny story to tell. At a Smith & Wesson Dealers' Seminar the factory was showing off their new Mountain Revolver, a 4-inch barreled stainless steel .44 Magnum, with a round butt, skinny barrel and beveled cylinder. It was designed to be the lightest .44 Magnum revolver that could survive a steady diet of factory ammunition. After breakfast, the factory representatives let the dealers loose on the range, with free ammunition and plenty of new Smith & Wesson handguns to shoot.

After shooting the new Mountain Revolver and missing the target spectacularly, one dealer could not get the empties to eject. Much struggling ensued. Finally one of the factory assemblers who had come along on the trip banged the ejector rod against a table top to get the empties out. That's when we found out the dealer had loaded .41 Magnum ammunition into the .44 Magnum revolver. The two calibers were close enough in size that the shooter hadn't noticed he was loading from the wrong box. The cases had bulged and split horribly, but the revolver was fine.

The only other calibers this easily confused are the .44 Magnum and the .45 Colt. The results of this mis-match are much more serious. Put .44 Magnum ammunition in a .45 Colt revolver (or one of its clones), and you will not just split the cases, you will also damage your Colt.

If you own a pair of revolvers in these two caliber combinations (.41/.44 Magnum or .44 Magnum/.45 Colt), be especially careful not to mix your ammunition.

Special considerations of the single-action

The single-action revolver is prone to many of the problems of the double-action revolver, and for many of the same reasons. A cartridge without powder in it will tie up the cylinder of a single action, or bulge the barrel, just the same as in a double-action.

Unique to the single-action are centerpin problems. Since it has no crane, the single action needs only a simple axle, or centerpin, for its cylinder. The very first Colt single-action cartridge revolver, known as the Peacemaker, used a screw to keep the centerpin in the frame. Shooters who lost the screw quickly found their revolvers unusable. The centerpin would jump forward, and the cylinder would not rotate until you lined the up centerpin with its seat in the rear of the frame and pressed it back into place.

Probably because they were receiving a lot of complaints from shooters with lost screws, Colt changed to a spring-loaded cross-bolt. Pushing the cross-bolt to one side released the centerpin. The cross-bolt stayed in the frame. The method worked fine even with the stout recoil of a full-power .45 Colt cartridge, but is not so effective when subjected to the recoil of a .44 Magnum. Not a problem for Colt — they never offered the SAA in a .44 Magnum.

Ruger does. Their .44 Magnum single-action revolvers, the Blackhawk and Super Blackhawk, use the spring-loaded cross-bolt to keep the centerpin in place. Under the repeated recoil of Magnum loads, the cross-bolt can become battered and start failing to do its job. If yours is looking beat up, you will have to replace the cross-bolt assembly.

Under the stoutest of .44 Magnum loads advocated by J. D. Jones, the centerpin can batter right past the cross-bolt, tying up the action. These loads, using 290 to 315 grain bullets at up to 1200 fps, are so heavy in recoil they aren't even any fun to shoot. Call me wimpy, but if I need that much performance I'll go get something with a shoulder stock on it. If you insist on using such loads, the only thing you can do is lay in a supply of cross-bolt assemblies and a couple of extra centerpins. Replace the cross-bolts as they become battered, and replace the centerpin when the recoil has battered its locking shoulder beyond repair.

On the original single-action design, both the two-leaf spring, which actuates the cylinder locking bolt and the trigger, and hand spring are fragile. If you plan to do any competitive shooting, or want to get lots of practice with your single action, buy several replacements for each. Since neither requires fitting, replacing them is easy.

Reassembly Tips:

Smith & Wesson

When putting a S&W revolver back together, a few steps seem to cause more trouble than the rest. One is the insertion of the cylinder locking bolt, and its spring, into the frame. The bolt has to go down its shaft, while the spring has to be squirmed back into the tunnel drilled into the front of the frame cutout. (I have no idea how they drill that hole.) With the frame resting on a padded surface, place the spring into its hole in the locking bolt. Start the bolt partway down the shaft until the spring bears against the edge of the frame. Use a small eyeglass screwdriver to compress the spring enough to clear the edge of the frame and push the bolt and spring down the shaft. When you get to the hole the spring will snap into place. Be sure the bolt is completely down the shaft, and pivots smoothly up and down through the cutout under the cylinder.

The second problem concerns the rebound block. The return spring is quite strong for its size, and resists efforts to push it in place. You will have to alter a screwdriver to fit the spring. Grind the tip so it is the exact width of the spring. Grind a shoulder on each side of the screwdriver to bear against the spring, leaving the center of the tip narrow enough to fit within the spring.

With the hammer and trigger already in place slide the spring into the rebound block and the rebound block in behind the trigger. The spring will rest on the rebound block retaining stud. With one hand, use your thumb to push down on the block enough to keep it from pivoting up. Use the screwdriver to compress the spring, pushing it into the rebound block. When the spring clears the retaining stud, push the block down with your thumb enough to capture the spring. Remove the screwdriver and push the block the rest of the way down.

Taurus revolvers

Despite similarities to S&W revolvers, Taurus uses a different method to spring-load the hand. S&W has a wound spring in the trigger; Taurus uses a coil spring and plunger in the sideplate. The Taurus hand travels in a slot in the sideplate. The plunger pushes the hand forward against the extractor ratchet. Getting these parts reassembled can be a hassle. The obvious — and wrong-way is to assemble the hand to the trigger, and then attempt to compress the spring and plunger as you press the sideplate in place. The problem is that anything strong enough to compress the spring will be too thick to get the sideplate in place.

The best method is to assemble the action into the frame, omitting the hand. Compress the spring and plunger into the sideplate, and put the hand in place in its slot. Hold the frame in one hand and the sideplate in your other hand. Position the sideplate against the frame, while simultaneously aligning the leg of the hand with its trigger hole. Once the hand is inserted into the trigger, jockey the sideplate around until it lines up with the frame. Press in place. This method takes a fraction of the time, and has none of the aggravation, of the wrong method.

Ruger revolvers

The Ruger double-action revolvers offer a couple of challenges all their own. The safety bar on the trigger assembly seems to catch on every interior edge inside the frame. To ease assembly, clamp the butt of the frame in your vise. Point the muzzle towards you. With one hand insert the trigger assembly from underneath. With the other hand use a dental pick to guide the safety bar past the cylinder latch and all other internal obstacles, until the trigger assembly latches into place. Do not pull the trigger while the trigger assembly is out of the frame. The assembly is designed to retain its springs when the mechanism is relaxed. If you pull the trigger you will launch three springs and plungers in three different directions.

The hammer of the Ruger goes in after the trigger assembly. With the trigger assembly in place and latched pull the trigger back. Hold it. Lower the hammer into the frame until you can line up the hammer pivot hole with the hole through the frame. Insert the hammer pivot pin. Let go of the trigger. The hammer and trigger should work normally. To check, take the Ruger out of the vise. Point it down and dry fire it double action. The trigger should work and the hammer should flop back and forth. Put the mainspring strut assembly in place, thumb-cock the hammer and pull out the capture pin. You really can't go wrong putting the hammer in after the trigger assembly.

Chapter 11 - Malfunctions of Pistols

Police Departments and Firearms Instructors who teach defensive shooting have plans for clearing a malfunction, or “reducing a stoppage.” There are very simple two-step plans, and there are elaborate plans requiring flowcharts and days of classroom instruction.

In this book we aren’t concerned with surviving a gunfight, but with the root causes of malfunctions and how to correct them once you are home from the range. Of course the best way to correct a malfunction is to prevent it from ever happening. You should not use a pistol for a match, hunting or defense until you have test-fired it and addressed any problems that occur. Once you have shot it at the range for hundreds of rounds without a single burp, you can depend on that pistol. Change your ammunition or your magazines, though, and you have to re-test.

Problem-solving with the pistol is much the same as with the revolver. You must study the malfunction, both in terms of what the pistol is doing, and what the pistol is failing to do. In what particular part of the operational cycle is the malfunction occurring? If, for example, the pistol fails to feed, you must determine what in the feeding cycle failed. What stopped the round from going forward? Does the fault lie with the pistol, the ammunition, or the magazine?

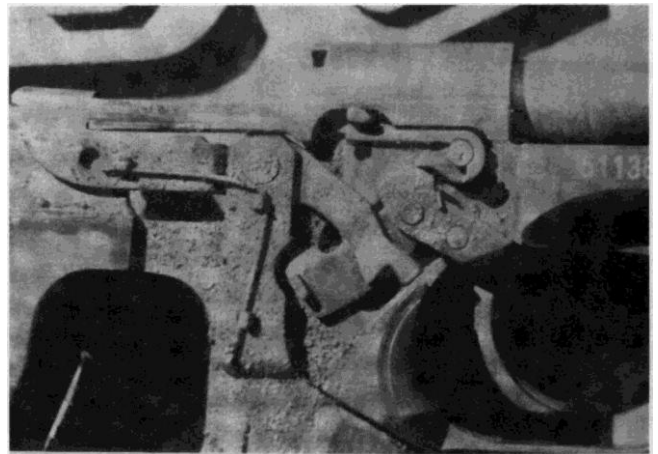
Or perhaps your pistol fails to eject reliably. Before you go bending the extractor to increase extractor tension, or installing a longer ejector, study the problem. Does the slide show brass marks from the empty cases? Where are the cases hitting? Could that be preventing ejection?

You could jump in for a quick fix only to discover later the root cause of the problem is something entirely different, and thus, something you still have to fix.

As with the revolver, the most frequent reason for a malfunction in a pistol is dirt. While some pistols can go for an amazing number of rounds without being cleaned and still perform properly, there are limits to everything. The limit for your handgun may be a few hundred rounds, or a few thousand.



A cutaway pistol, such as this Caspian, is useful to show how a pistol works.



This HK P-7 has digested more than 4,000 rounds at this point without a failure. With proper cleaning it may never fail, (photo courtesy Massad Ayoob.)

Curious about the functionality of one of his HK P-7 pistols, Mas Ayoob of the Lethal Force Institute tested it in his firearms training school by using it as a loaner. When a student showed up for class sans pistol, or with an unsuitable handgun, out would go the HK P-7 loaner. If a student’s pistol broke beyond repair the HK P-7 would see service. When loaning the pistol, Mas always provided the same set of instructions to each student: “Don’t clean it, and stop immediately if it malfunctions.” He ended the test after 4,000 rounds. The pistol still worked perfectly. There had not been a single malfunction.

I do not recommend this course of action, if only because that sort of treatment seriously wears the bore of a pistol and greatly shortens its accurate service life. But Mas' test does give you an indication of the level of reliability a properly-tuned pistol can deliver. With regular cleaning, that HK P-7 might never malfunction, although a part could break. Even the best-quality parts break from time to time. If you own a pistol that performs very reliably, and after tens of thousands of rounds that one part in 10,000 breaks, box the part up, send it back and see if you can get a free replacement. If not, select the best part for your pistol, buy it and install it, even if it is from the same manufacturer. After all, what are the odds you'll get another "one in 10,000" part?

It's a different story when you're breaking the same part regularly. Chances are, something you are doing is placing the part under much greater stress than it was designed to withstand. Study what you are doing to that poor part, and relieve its stress.

In addition to the grubby gun syndrome, pistols also malfunction due to poor-quality ammunition. Low-quality reloads, produced with tired brass, improperly sized or seated bullets, or improper bullets, cause a large number of headaches at the range. In a revolver, where you place the cartridges in each chamber by hand, when one doesn't fit you can just lift it out. In a pistol the slide has to chamber a round from the magazine. If the round doesn't want to go in, you may have a struggle on your hands getting it out. It can be tightly wedged in place.

BE CAREFUL!

Trying to remove a live cartridge, one that didn't chamber and doesn't want to come out is a very hazardous thing. At the range, or at home in your workshop, be very safety-conscious.

Remove the magazine. You are struggling with only the one cartridge. There is no reason to keep a ready supply of others in the pistol. If you do not remove the magazine, as soon as you clear the offending cartridge another round will be chambered. In the relief that follows clearing a stuck cartridge you may forget you still hold a loaded pistol. Not good.

Keep the gun pointed in a safe direction. At the range, you must keep the muzzle pointed down-range. In your home workshop, keep the muzzle pointed at something solid and hopefully inexpensive. Don't just point at the wall—think about what is on the other side of that wall. If, during your struggles, you end up fully chambering this round and firing the pistol, you want the bullet going in as safe a direction as possible.

To remove the round, find a wooden post or table. Place the front of the slide, next to the muzzle, against the edge of the post. Hold the slide to the post with your weak hand. Pull your shooting hand back a foot from the butt of the pistol and whack it, still holding with your weak hand. Grab the butt of the pistol as your hand strikes home. The impact should jar the cartridge loose. If not, strike again a bit harder. When you have freed the round check the extractor. The banging can damage it.



The two rounds on the right have bullets seated too deeply. The two on the left have bullets that are not deep enough. None will feed worth a hoot. If your reloads look like this, do not blame your pistol for not working reliably.

Don't hold the pistol and bang the end of the slide against the post or table. Doing this bangs the muzzle against the wood, which doesn't help. It is the slide that must be freed. You may end up striking at an off-angle, and hard enough, that the pistol can turn in your hand, pointing someplace unsafe.

Save the round, for study to prevent this problem occurring in the future.

In a more stressful situation, such as hunting or defense, you must be ready to use your pistol as soon as you clear the jam. Leave the magazine in. Remove the round by striking your hand against the butt of the pistol, as above. When you are trying to clear the cartridge, do not point the muzzle at yourself. Once cleared, remember that your pistol is loaded, and you are now ready to continue the match or the pursuit of your quarry. Don't bother with the round you've removed. If circumstances permit, look for it later.

The next likely reason for a malfunction, and one unique to pistols, is use of a poor-quality magazine. Saving a few dollars on magazines is a perfect example of being "penny wise and pound foolish." The worst deals are what I call "Two for 10-dollars gun-show specials." I will occasionally see a customer in my shop who wants his 1911 pistol to feed reliably, but who insists on using tired, beaten, worn and heavily-used magazines he bought at a local gun show because they were "a bargain."

Getting such pistols to feed reliably with good-quality magazines is usually just a few minutes' work. Convincing the customer to pay five or six times as much for a good magazine as he paid for his "bargain" takes much longer. Without the proper magazines, the work I did (and you will do) is wasted.

Back when I started to shoot competitively, one of the fellows in our club was inordinately fond of his pistol. He was especially proud of the fact that as he shot most of his brass “went into a coffee can.” His pistol did, indeed, eject very consistently. If you placed a coffee can on the ground an amazingly high percentage of the brass would be in the can when you were done shooting. Neat, right?

Except for two problems. The handgun wasn’t particularly accurate, and the owner couldn’t shoot it very well.

Too much attention paid to unnecessary details can blind you to more important things. A thought to live by.

When working on your pistol, you must separate the unimportant “fussy stuff” from actual problems. Ejection on a 1911 provides an excellent example. One of mine brasses the ejection port area. Although I have to scrub the marks off the slide with steel wool each time I clean the pistol, I haven’t bothered to track down the reason. And why should I? The brass never fails to eject. It’s never dented. Who cares if it’s leaving a mark? As far as I’m concerned there isn’t a problem.

I shoot another .45 with a very wide ejection pattern. The brass can be found forward and back, near and far. I haven’t worried about this one either. Unless the brass is coming back in my face the ejection pattern is of no concern to me.

On the other hand, if you have a pistol whose ejection pattern suddenly changes, and you haven’t changed your ammunition, you may have a problem. If your pistol used to throw the brass three shooters to the right, and now it falls at your feet, you should check into things. And empties in your face? That deserves an immediate inspection. I’ve fired a Desert Eagle in .44 Magnum that ejected the empties into my face, hard. It was no fun.

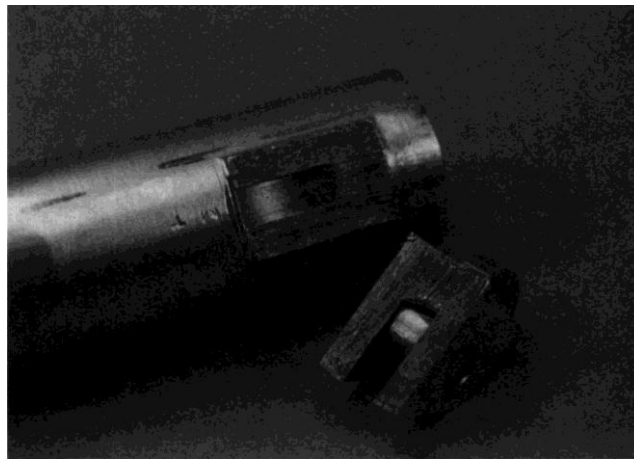
You may find that the simple act of using your pistol creates a dilemma for you. The wear to the finish from shooting, cleaning, drawing and re-holstering; the scratches to the frame from inserting magazines; the occasional rub mark from shooting next to a barricade—all leave their reminders. If the wear to your pistol troubles you, investigate harder finishes. Keep in mind, though, that those annoyingly bright comers do not affect your pistol’s function. Instead of investing heavily in cosmetics, you may want to save your money for more practice ammo or for true malfunctions that require fixing. The choice is yours.

While I will be going over the causes of malfunctions here, the detailed solutions will be in the chapters devoted to your particular pistol. For the 1911, see Chapter 19. For the Glock, see Chapter 16, and the Beretta see Chapter 17. Magazine solutions will be in Chapter 12. Many of the problems occur in all pistols. Even if you are working on a different pistol, reading about the others can provide helpful information.

Ammunition problems are only generally covered. The proper reloading of ammunition is covered in other books available from Krause Publications, and you should obtain and study these if you have persistent ammunition problems.

Feed

In order to shoot, your pistol must get a round into the chamber. If it doesn’t, and you’ve made sure there’s a loaded magazine in there, start with the feed stroke. Like a well-crafted story, the feed stroke has three areas to check: the beginning, the middle and the end. Not highly technical, I’ll admit, but there it is.



This .45 barrel did not survive the combination of faults. Hot loads, a light recoil spring, incorrect fitting and lots of shooting combined to break this lower lug right off.

In the beginning the breech face of the slide contacts the rim of the cartridge and pushes it forward under the lips of the magazine. (See Chapter 4 for the detailed explanation of the functions of a revolver and a pistol.) Most malfunctions at the start of the feed stroke are magazine-related. If the feed lips have been abused or incorrectly modified, or if the magazine is of such poor quality that the lips won’t hold their shape, the cartridge will not feed reliably. Magazine tubes that are poorly dimensioned can shift in the magazine well and affect feeding. If the mag catch slot is cut in the wrong location the magazine may sit too high or low and not feed properly.

When a problem occurs at the beginning of the feed stroke, you’ll usually find a cartridge nose down in the magazine, wedged against the feed ramp. The magazine with abused feed lips may sometimes give up the ghost by “porpoising” the round, trying to throw it out the top before it can make the trip into the chamber.

To see if you have a faulty magazine, switch to a new one of known quality. In the 1911 I've had great success with Wilson, McCormick, Ed Brown, and Mag-pack. To test your Smith and Wesson nothing beats a new Smith magazine. For many other pistols I have had excellent results with Mec-Gar magazines. With factory ammunition in one of these magazines, you can be certain any feeding problems are not related to the magazine or ammo.

The middle of the feed stroke, like the middle of a story, contains all the heavy action. As detailed in Chapter 4, the front of the round must feed up the ramp, hit the chamber top and cam over the corner of the chamber and feed ramp junction. While this is going on the rim of the round has to slide out of the feed lips, and start going up the breech face. While the bullet nose is camming up and down, the rim has to slide into place under the extractor without binding. This is the trickiest part of the feed stroke to investigate, because so much is going on.

A feeding problem in the middle of the cycle will often send a new shooter to the feed ramp, which he will polish to a mirror finish in a hopeless attempt to solve the problem. The feed ramp must be at the right angle, and in the correct location on the frame for the pistol to operate properly. If these dimensions are correct the level of polish hardly matters. Don't be distracted by the ramp, or by "throating" the chamber. In my years of shooting and gunsmithing I have heard many explanations of just what "throating" is. None of them makes sense to me.



The right case is severely swollen at the base. The center case is perfect, the left-hand case was swollen, and the sizing die did not remove all of the swelling. The base still has a ring around it, just above the extractor groove. This ring will prevent the case from chambering, and wedge the pistol tight.

Malfunctions in the middle of the feed cycle are usually ammunition related.

Carefully examine the slide for burrs or machine marks on the breech face or breech face sidewalls. Either one can bind the cartridge rim, preventing reliable feeding. The joint between the feed ramp and the chamber, called the cam-over edge, is sometimes a source of difficulties. If either part has been polished, the edge may now be too sharp, digging into the side of the cartridge. If the chamber has been reamed out, the edge will certainly be too sharp. The cam-over edge must be rounded, but only slightly. Too much, and you will leave the case unsupported. If you reload your ammunition to high pressures, an unsupported case can bulge. The bulge may not be entirely ironed out by your sizing die, and can cause chambering problems later. You will have solved one problem, but created another.

Chamber

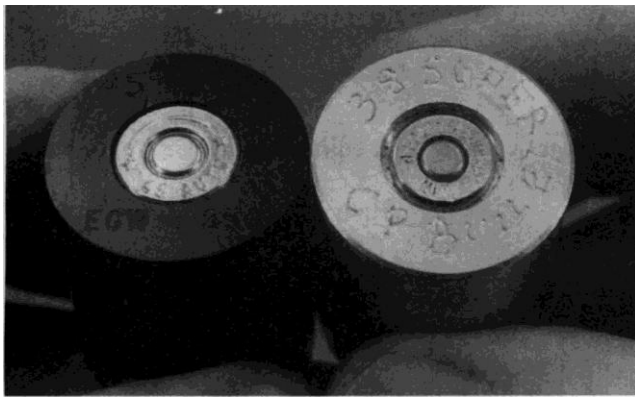
At the end of the feed cycle the round fully chambers, and the barrel cams up into locking position. Years ago, the common advice for a round which failed to chamber was to smack the back of the slide. I have a very clear memory of the last time I did this. It was the summer of 1983, and I ended up bleeding all over my pistol and magazines. I had cut my hand on my Bo-Mar rear sight.

If your pistol fails to fully close, and you have some time, stop and take a close look at the jam before clearing it. You will likely find that one of your rounds was not fully sized down. Failing that, the chamber is probably very dirty. Occasionally, you may run into a pistol with a rough, short or undersized chamber. When clearing the round, don't just smack the slide to close it. You'll only make the problem worse. Instead, work the slide and remove that stubborn round.

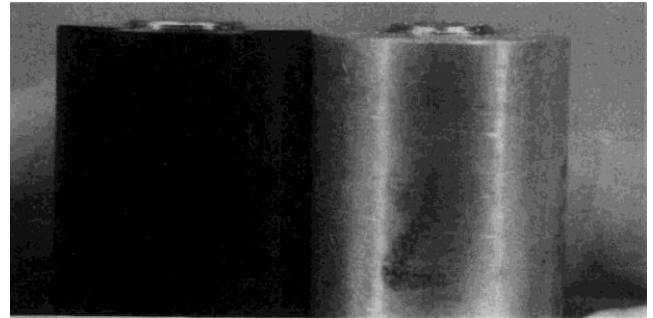
Get your finger off the trigger. Hold the pistol out from your body, with the muzzle pointed down-range. Grab the slide and try to open it. Do not try to gain more leverage by pulling the pistol close to your body and pushing your hands towards each other. You will end up pointing the muzzle to the side, at the shooter next to you, or even worse, at yourself.

If pulling fails, find that post or bench-top we discussed earlier and strike the back of the butt with your hand. Save the jammed round.

Once home, get a case gauge to check the round that failed to chamber. The gauge is a cylinder with a minimum-sized chamber reamed in the center. Drop the offending round into the gauge. If it drops in flush with the rear it passes muster. If the round sticks up out of the gauge it is too large somewhere. Spot check some of your other rounds. Do they also have sizing problems? Study your reloading and correct your ammunition. You may have to scrap your brass and start with a new batch. Try adjusting your sizing die, or, if it is already touching the top of your shell plate, consider buying a Case-Pro 100 from Image Industries, to iron your brass down. If you buy ammunition reloaded by someone else, think about finding a new supplier.



Obtain ammo gauges and check your reloaded ammo. The rounds must drop flush, and fall out, or they don't pass.

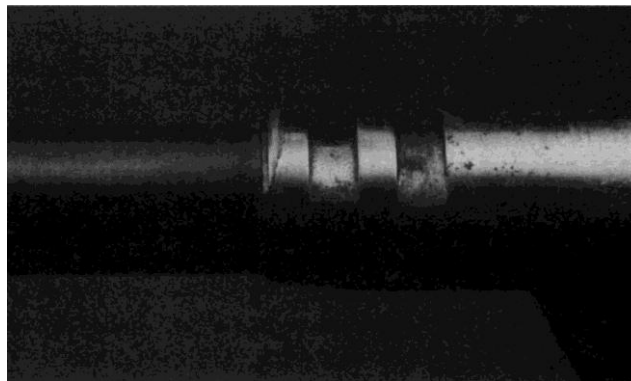


Use ammo gauges to check your reloads. These rounds have not been properly sized, and are too large for the gauges. They may or may not be too large for a pistol. Set such rounds aside and use them for practice.

If your ammunition gauges correctly, even the round that wedged on feeding, you may have to open up your chamber. A rough, undersized, or out of round chamber can stop even a factory cartridge. You can purchase a chamber reamer in your caliber, cutting oil and a large tap wrench. We'll be covering this procedure fully in Chapters 16 and 19. Again, the cost of these tools may exceed the cost of having your gunsmith do the job, and you only have to do it once to each barrel. If you buy the tools you might never have to use them again.

Lock

Once the round is fully seated, the barrel cams upwards to the locking lug or lugs in the slide and the slide moves to its fully forward position. Failure to lock is usually due to bad ammo or extreme dirtiness. To quickly establish which, determine how near the slide is to being fully closed. If the slide is held out of battery by just the smallest amount, and it can be pressed closed with a thumb, then the problem is dirt. If the slide is held out of battery 1/8-inch and stubbornly refuses to move when you press on it with a thumb it is likely a bad round.



This is a soft, cheap barrel that was improperly fitted. The slide peened the barrel until the upset metal bound against the inside of the slide enough to crack the barrel on the bottom. Buy good parts and fit them properly.

An extreme case of failure to lock comes from poor-quality components. A soft barrel or slide, or a barrel that has been improperly fitted to a slide, can peen the locking lugs. The barrel in the photograph was both soft and poorly fitted. The front locking lug took the full brunt of the locking load, and was soon peened badly, interfering with the pistol's functioning. The owner "solved" his feeding problem with a heavier recoil spring. The increased forces that resulted peened the locking lug even more, building the ridge on top of the barrel to the point where it bound against the inside of the slide. The stress on the barrel cracked it on the bottom, and accuracy suddenly disappeared.

Miraculously, the slide was not damaged. Properly fitting a new barrel solved all the problems.

Fire

The scariest sound in the world is not a roar or a scream, but a click when you were expecting a bang. Sometimes the reason for this failure can be quite subtle. The first thing to check is the power of the hammer fall. Have you clipped the hammer spring of your pistol shorter in order to make the trigger pull lighter?

Firing pins rarely break, but check anyway. While you have it out, scrub the pin, its spring and the tunnel it travels in. Firing pin “failure” more likely stems from dirt than anything else. I have cleaned 1911’s which were so dirty that pulling the firing pin from the slide created an audible sucking sound. In one pistol the firing pin and spring were so caked with petrified oil, powder residue, dust and lint, it was a miracle the pistol fired at all. On the Series 80 Colt pistols, check that the firing pin safety parts were correctly installed and that the trigger travel hasn’t been restricted so much that the firing pin can’t get past the safety plunger.

Installing a new target trigger with an overtravel screw in a Series 80 pistol can bind the firing pin safety. If you turn the overtravel screw in too far the hammer can fall but the firing pin safety may not be pushed fully out of the path of the firing pin. When you take the firing pin and its part out, look at the firing pin safety. Does the corner of it have a large number of little “dings” in it? They are caused by the firing pin catching on, but pushing past, the safety. De-burr the safety, and turn your overtravel screw out at least half a turn.

Unlock

Rarely does a pistol fail to unlock, but when it does, the cause may be underpowered ammunition. Severely underpowered ammunition will leave a bullet in the bore. Firing another shot will then bulge the barrel. If you fire a round and the pistol doesn’t cycle, DON’T just work the slide and fire another shot. You MUST stop and investigate.

An underpowered round which leaves a bullet in the bore is easy to fix. Remove the magazine and lock the slide back. Slip your range rod in the muzzle and, with a tap, push the bullet back out of the bore. The rest of that batch of ammunition should be viewed with suspicion. Fire it slowly and make sure each round fired produces a hole in the target. Do not use the remaining ammunition for any high-speed practice. Once you finish the batch, study your reloading system to see how you could have produced a round without powder.

If you overlooked the squib round and fired another, you have a real mess on your hands. The barrel may be bulged enough to wedge the slide. Remove the magazine. You will have to bang the back of the slide hard enough to free the slide from the barrel, so you can disassemble the pistol. Use a plastic mallet or a piece of wood. Inspect the bushing to see if it was damaged. Striking the bulge may have bent or cracked the bushing. If so, replace it. Think about what barrel you will buy to replace the bulged one.

You must get a new barrel. Some shooters think they can file down the bulge and keep using the barrel. Doing this is asking for a very serious problem. The barrel will be thinner where it bulged and was filed. It may crack or burst if you continue to use it.

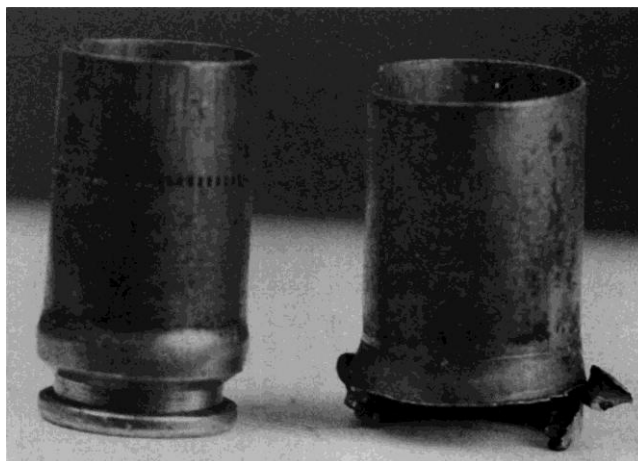
If the barrel is only slightly bulged the slide will continue to work. You may not see the bulge for a few hundred rounds, or your next thorough cleaning. What you may have noticed is a drop in accuracy. On cleaning, you may find accelerated leading or copper fouling from the powder gases that have blown by the bullet as it passed the bulge. Consider yourself lucky to have gotten this far without further bad luck and look into buying a new barrel, soon.

Extract

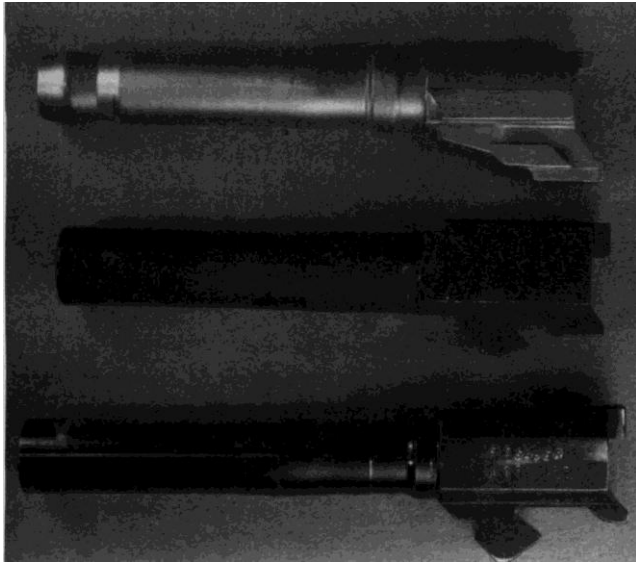
Extracting is the act of yanking the empty out of the chamber. Do not confuse extraction with ejection, where the fired case is tossed overboard.

The failure to extract is usually an extractor problem, sometimes a chamber problem, and occasionally both. If the extractor fails to pull the fired empty out, the pistol usually tries to feed another round. Check the extractor tension first, and then look for broken extractor hooks. An extractor that is bound with petrified oil, grease and powder residue may be held away from the case, and unable to grab the rim. The only two pistols I have seen with chipped or broken extractors are Glock and 1911’s. The Glock extractors I have seen chipped are all in .40 caliber, and were all on high-volume police pistols. The 1911 extractors suffer the indignity of being experimented on to a much greater degree than any other pistol. Replacing an extractor on a Glock is simple. With a 1911 the operation is only a bit more complicated.

Even if you locate your problem in the extractor, checking the chamber to see if it is rough or undersized is a good idea. After all, the extractor lost tension for a reason, and hauling the fired empties out of the chamber against the additional friction of a rough, pitted, or undersized chamber can tax even a new extractor. A rough chamber can be polished, an undersized one can be reamed out. The only thing to do with a pitted chamber is replace the barrel.



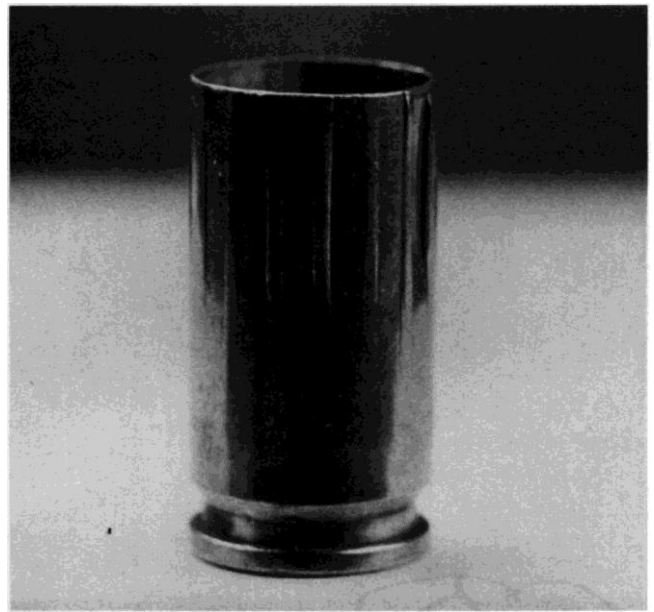
The case on the left is really swollen. The one on the right couldn’t hold out, and blew apart. The load was too hot and the barrel had been ramped too much. The ramping was to “improve feeding.” The pistol feeds fine, but the cases don’t survive to be reloadable.



These three barrels were bulged by squib loads being followed with regular ammunition. Cheap reloads strike again.



Seen at an angle, the bulge in this barrel is obvious.



This case came out of an H-K MP-5 submachine-gun. The flutes that aid extraction also crinkle the cases, this case can be reloaded once again, and then it will expire.



Primers that look this bad are definite signs of either a load that is too hot, or excess headspace. Check your powder charge, and measure your chamber.

Eject

The empty is unceremoniously tossed away like last week's tabloid newspaper. Hot and dirty, it is left on the ground until you are finished. The causes of failure to eject are usually insufficient extractor tension, a loose ejector, and occasionally lightly-loaded ammo.

Proper extractor tension ensures ejection. To check extractor tension you need a tension gauge in your caliber, and a trigger pull gauge. See the chapter for your particular handgun.

The original 1911 did not have a large ejection port, and the ejection was designed to be upwards, not sideways. A common modification on the 1911 (unnecessary on other pistols) is to lower the ejection port, which gives the empty more room to escape, and tosses it to the side. It is also very common on the 1911 to install an extended ejector to strike the empty sooner in the slide cycle when the slide has more velocity. The result is a more brisk and certain ejection. If you install an extended ejector on a 1911 without modifying the ejection port you may create a traffic jam. The extended ejector is designed to throw the empty to the side. The unmodified port is designed to let the empty escape upwards. Many times, the empty will not be able to climb out. Make sure your port is low enough, before you install that extended ejector. These are covered in Chapter 18

Modern pistol designs have large, open ejection ports for the empty's escape. The Beretta is the winner here, having essentially no slide to interfere with ejection.

Cocking

Failure to cock rarely causes a pistol to “machine-gun.” Many people think that if the hammer follows the slide down, the pistol will fire. That is not the case. If the hammer simply goes forward with the slide, it won’t have enough force to set off the primer. If the hammer stays cocked until the slide closes, and then falls, you’ll have a double. In this instance, the delay in falling gives the hammer sufficient force to set off the primer.

The hammer’s failure to stay cocked can be caused by dirt, improper assembly, broken parts, or, in rare and mysterious cases, the shooter himself. I once spent an afternoon tracking down the problem of a pistol whose hammer followed the slide down— but only when fired left-handed. Cocked by hand, the hammer would not stay cocked. Cocking, then releasing the hammer, allowed you to fire the pistol, but it still wouldn’t cock after it had fired this way. It turns out that the knuckle of the shooter’s left forefinger was striking the bottom of the safety, and the bumped safety was binding against the bottom of the sear, keeping it from re-setting.

A broken or improperly-modified hammer and sear can fail to cock. Look for hammer hooks that have been stoned too short. Or if the sear tip was stoned to the smallest possible point it may be fragile and prone to breakage. If your pistol suffers from these “modifications,” you will have to replace the parts. If it is a used pistol you just bought, you may have recourse with the dealer from whom you bought it. If not, replace both the hammer and sear. If the previous owner worked on one, he probably worked on both.

Improper assembly can keep the hammer from staying cocked. Check that the sear is under spring tension to force it into engagement with the hammer hooks. If it isn’t, you have found your problem—a problem you probably can’t blame on a previous owner.

And finally, make sure you’ve looked for every gunsmith’s favorite problem: a hammer-sear assembly so caked with gunk that the parts are too sluggish to keep the hammer cocked. This problem is easy to solve. Just keep the pistol clean.

Projects



Chapter 12 – Magazines For The Autoloader

In most cases, a pistol without a magazine is an awkward single-shot handgun. In the case of the Smith & Wesson pistols, with their magazine safety, they are not even a single-shot but only a clumsy club.

It follows, then, that you must have magazines for your pistol. And not just any magazines. You must have good-quality, dependable magazines, and enough of them for your needs. Once you have them you have to take care of them or your investment will be wasted through neglect or abuse. At some point you may want to modify them, to improve their function or reliability.

Manufacturers ship pistols with one or two magazines. When you buy a used pistol you may only get the magazine that is in it. While a pistol with a single magazine works, it can be a drag at the range. If you are going to shoot in competition, or want to have more fun at the range, you will have to buy more. When buying, remember that pistols were once viewed as much less reliable than revolvers, mostly because of their magazines. The cheapest magazine is in many cases the worst bargain. The most expensive magazine is often the best bargain in the long run.

Getting good ones

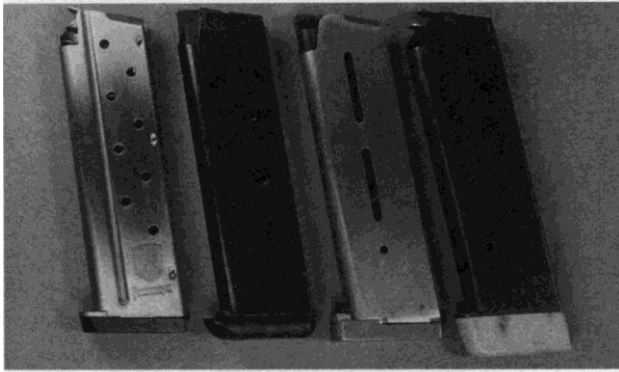
It used to be that finding good magazines was a chore. Shooters did not loan magazines (still a good idea, by the way) because reliable ones were too rare a thing to part with — even temporarily. As recently as the late 1970's I would sometimes buy twice as many magazines as I needed for a given handgun, so I could be sure of finding enough reliable ones. The rest? I sold them to other optimistic shooters.

When police departments began switching to pistols from revolvers they absolutely would not tolerate unreliable pistols or poor-quality magazines. As a result, the quality of the magazines sold with police pistols is top notch. Glock, Beretta, Ruger, Sig-Sauer and Smith & Wesson all make police pistols. If you want reliable functioning from these pistols do what police forces do. Buy the magazine the manufacturer makes. Except for Mec-Gar or Millett, other high-capacity magazine manufacturers may not give you the same satisfaction.

For 1911's, the demand for improved magazine quality started with competitive IPSC shooters. The matches would not allow an "alibi," or re-shoot because of a malfunction. Once shooters became willing to pay anything for reliable magazines, manufacturers started making better magazines. One of the first was Bill Wilson, who started making .45ACP magazines in 1980. I bought some right away, and more later. They have yet to give me any problems.



The old-style tapered feed lips on the left, and the newer, shouldered lips on the right. Generally, the newer style feed more dependably than the old. This is not an ironclad rule, and you may get fine results from a magazine with the old style.



The Pachmayr magazine on the left came with a rubber base pad attached. It is also a 9mm magazine. The crease is for feeding, not to decrease capacity. The next magazine is a Mag-pack, eight rounds of .45ACP and an included mag pad, also black rubber. The Wilson-Rogers magazine has a brass base pad, and the McCormick magazine on the right has a CP bullets bright green rubber pad screwed on. All the pads work, it is just a matter of taste which one you use.



The patented follower on this Chip McCormick 1911 magazine increases the capacity to eight rounds of 45ACP without making the magazine any longer.



New production magazines can only hold 10 rounds. This Mec-Gar magazine on the top is for the Browning Hi-Power. The one on the bottom is an older, 13 shot magazine. Both are the same size, and both work just fine.

Soon after Bill Wilson, other magazine makers cropped up. Now, finding reliable magazines for the 1911 is simple. Buy from one of the “old” names — Wilson, McCormick, Mag-pack, Ed Brown, Millett, and you will not have problems. All offer impressive warranties. If your magazine cracks or breaks, and you haven’t “improved” it with a pair of pliers, you’ll get a new one. Chip McCormick even goes so far as to take samples from production and regularly test them to destruction. If Chip can wrestle a welded baseplate off of one of his magazines, someone was lazy in the welding department and will hear about it.

For pistols other than the 1911, your best bet is either the manufacturer, Mec-Gar or Millett. In some cases, the “factory” magazines you buy will have been made for them by Mec-Gar.

If you are looking at a magazine out of its package, perhaps a used one, give it a thorough inspection. Each manufacturer has a distinct, if subtle “look” to its magazines. Sometimes, as in the case of the Wilson magazines, the look is not so subtle. Is the magazine a name-brand one? Great. Check the magazine tube for hammer or plier marks. While you’re at it, check for tire tracks, too. If you see none, then bargain for a good price.

If you see any of the above, especially marks from pliers, put the magazine down and forget it. Even if it were free, it would be too expensive to own. Magazines that have had the feed lips “adjusted” with pliers are always feeding headaches, and never work 100 percent.

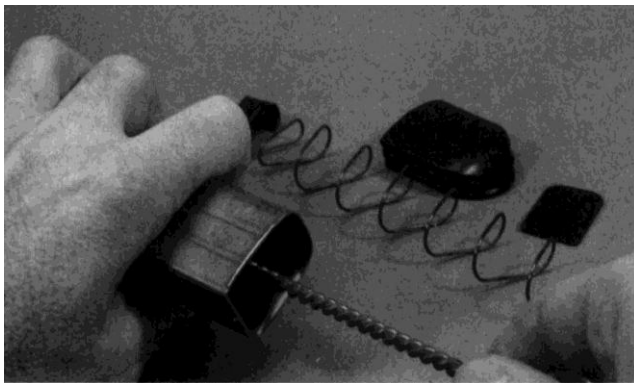
If the magazine is not a name brand look at the quality of its construction. Look especially hard at the weld. Most magazine tubes are formed by wrapping sheet metal around a form, and welding the joint in the spine. A good magazine will have a single continuous weld down the length of the spine. If the weld is ugly, uneven or ground down, pass. A magazine with the spine folded over and spot-welded should also be passed over. Tap the tube itself. Does it sound tinny, like it’s made of soft or thin steel? If so, leave it.

There are enough good-quality magazines out there that you can afford to pass up a dubious “bargain.” What costs you money is the cheap magazine that never really works well enough.

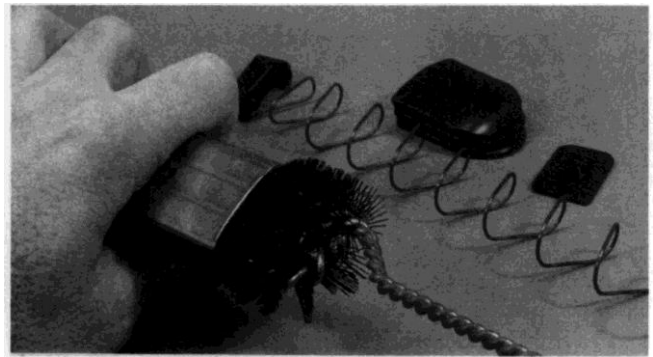
Treating them well

Except for the Glock magazines, your magazines are made of steel and prone to rust. Even a magazine made of stainless steel, or one with an electroless nickel finish, has a carbon steel spring in it.

If you have been in the rain or snow, or your magazines have fallen onto wet ground or grass, you should wipe them off. Strip the spring and follower out of each of them one at a time, and wipe these parts dry. If you find the spring or follower rusted, use 0000 steel wool and light oil to scrub it clean. Leave the spring lightly oiled from the scrubbing, wipe the oil off the follower, and do not oil the inside of the magazine.



Keep your magazines in good working order by cleaning them.



This brush scrubs grit and dirt out of the magazine interior.

Do not let your magazines stay wet for any length of time. Many years ago, after shooting a match in a driving rain, I got home so tired I only had enough energy to pull my pistol out of my shooting bag and wipe it down. I left my wet magazines in the bag. The next time I went to the range, my magazines were crusty red lumps. It took a lot of scrubbing to get them clean. I had to learn this lesson again, after I had retired the magazines made of carbon steel and switched over to stainless. After that second rainstorm, I found my springs and followers red with rust, even though the magazine tubes were fine.

Some shooters have an inordinate fear of dropping their magazines. Some even put plastic or rubber bases on their magazines to ease the shock of the magazine hitting the ground. Don't worry. A good quality magazine will not be damaged by dropping it onto the ground. Concrete may be a problem. I've used Wilson magazines for many years in my Colt .45, and have dropped each of them hundreds of times. They are still working fine. If you are shooting at an indoor range, and the floor has some sort of carpeting, then your magazines will be safe from the concrete. I have dropped magazines right onto concrete and, while I wince each time, I have yet to find a magazine damaged by the fall.

The basepads don't help in falling, but are useful in loading.

Maintaining them

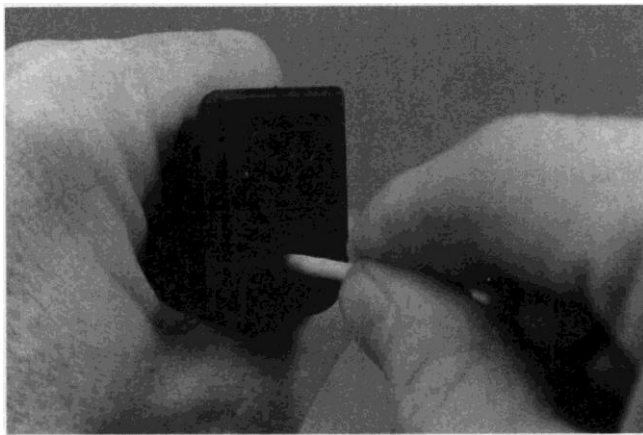
The only magazines made today without a removable baseplate are certain 1911 magazines. To disassemble the non-removable baseplate magazines, push the follower half-way down with a pencil or dowel. Take a drift punch that fits through the view holes in the magazine, and push the punch through the magazine. Select a view hole that will let you capture the magazine spring, but not the follower. With the spring captured, turn the magazine upside down and gently tap it until the follower falls free.

Hold your hand over the magazine lips, and pull the drift punch out. Before you remove the spring, make a note of its orientation. The top coil of the spring is designed to fit against the follower a certain way. You'll want to put it back that way when you reassemble it.

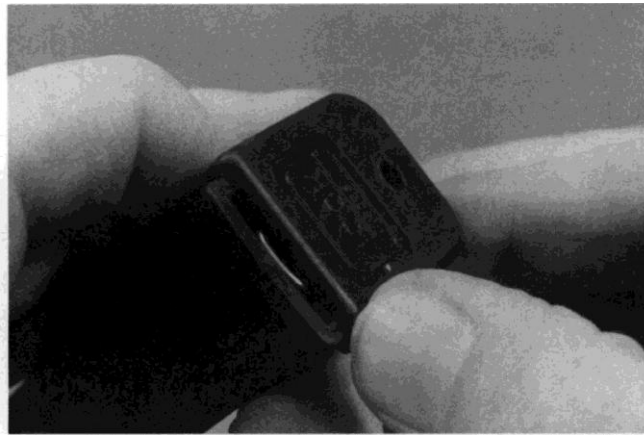
To reassemble, push the spring back and compress it fully into the magazine. Holding the spring down with one thumb, slide the follower into the magazine with the rear leg parallel to the feed lips. Once the corner of the follower is in the magazine tube rotate the follower to its upright position. Remove your thumb from the feed lips. Reach under the follower with a dental pick, and push the top coil of the spring until it correctly bears against the follower.

Except for Glocks (see below), magazines with removable baseplates are easier. On the bottom of the baseplate you'll find a hole. A retaining plate inside the magazine locks in this hole. Use a drift punch to push the retaining plate away from the baseplate. Push the now-unlocked baseplate off the rails on the bottom of the magazine tube. With the baseplate off, the locking plate, spring and follower will come out of the bottom. If you aren't careful, they will launch out. Again, note the spring's orientation. It is designed to fit only this way. If you swap it end for end, or turn it front to back, the magazine will not feed properly.

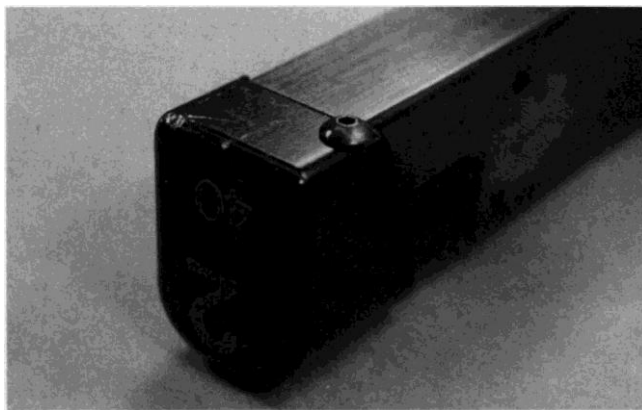
With the magazine apart, wipe or scrub the follower and spring. Brush or swab out the magazine tube. Do not oil them. You can prevent malfunctions of your high-capacity magazines by lubricating the interior of the tube, but not with oil. A spray silicone that dries on the surface can keep your cartridges sliding smoothly, without attracting grit or dirt. Most outdoor ranges have a large amount of dust or sand and the silicone will keep your dropped magazines from collecting too much gunk.



To disassemble the Glock, press a punch into the bottom hole until the inside plate snaps to the side.



Squeeze the sides of the magazine and slide the floor-plate off.



This is a CPMi magazine base pad for the EAA Witness. It increases magazine capacity by two rounds of 40 S&W. The small screw keeps it from shifting.

To reassemble, first place the follower, spring and retaining plate in the tube. Make sure the spring is oriented correctly. Compress the spring and retainer. While holding them in place with one thumb, slide the baseplate on. Look through the hole in the baseplate. If the retaining plate is not locked into this hole, tap the side of the magazine until the retaining plate snaps into place.

For Glock magazines, push the drift punch into the baseplate hole until the retaining plate snaps out of alignment with the baseplate. The Glock magazine tube has two little shoulders on its bottom rails, to keep the baseplate from sliding off. You must squeeze the bottom sides of the magazine to remove the baseplate. Reassembly of the Glock magazine is the same as other removable baseplate magazines. Again, you must squeeze the bottom of the magazine, this time to get the baseplate to clear the locking shoulders and snap into place.

Improving them

The first thing you can do to improve your magazines is buy the best. Having done that, mark them with your name or initials. Now you can decide what other upgrades you want: a basepad, plating, increased capacity.

Why mark your magazines? So you'll get them back, or at least be able to identify them. If you are shooting in a match that requires reloads, you and the other competitors could end up with a bunch of magazines scattered over the firing line. I used to shoot PPC with the local Sheriff's Department. The last firing sequence called for 24 rounds from 4 magazines from each of us. We would end the course of fire with over 30 magazines on the floor. Marked magazines were easier to sort out.

The simplest marking method is to use a stencil and spray paint. Use your initials or simply number your magazines. Heck, paint is cheap, do both. Between your initials, the number and the color of the paint, you should be able to find your own mags.

An electric pencil works too. If you are feeling particularly posh, you can find that booth at the local mega-mall that engraves gifts. You may be able to get them to engrave your name or initials on your magazines.

You can also make your magazines easy to find, and separate them from other shooters mags by using a particular color of basepad. They are available in colors that will sear your eyes.

Protecting them

If you have reliable carbon steel magazines you can protect them from rust by plating them. Robar will NP3 plate them and Accurate Plating will hard chrome them. With either method, your magazines will last much longer and work much more smoothly. The cost can run as much as a third of the cost of the magazine, but that is still less than buying a new stainless magazine.

As with your handguns, send your magazines for plating only after you have done everything else you want to them. Fire enough rounds through them to determine that they work 100% for you, mark them, then send them for plating.

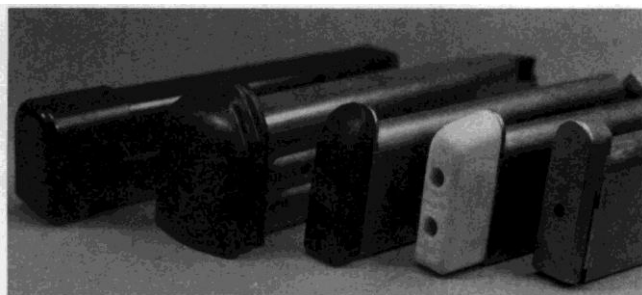
Modifying them

Basepads or buffers make it easier to insert the magazine, especially if you have a magazine funnel. If you do not have a funnel the extra length of the basepad keeps you from pinching your hand between the magazine and the magazine opening. Some magazines already have an oversized baseplate which acts as a basepad. The Glock and Beretta both feature oversized baseplates. The 1911 magazines with attached baseplates do not. However, many magazine makers provide a buffer pad and screws to secure the pad. To make it dead simple they even drill two holes in the magazine for you. The screws are euphemistically called “self-tapping.” Don’t count on it. The magazine steel is hard and screws are small. Rather than exhaust yourself trying to self-tap the screws, go to the store (or call Brownells) and buy a 4-40 tap. Tap the holes then screw the pad on.

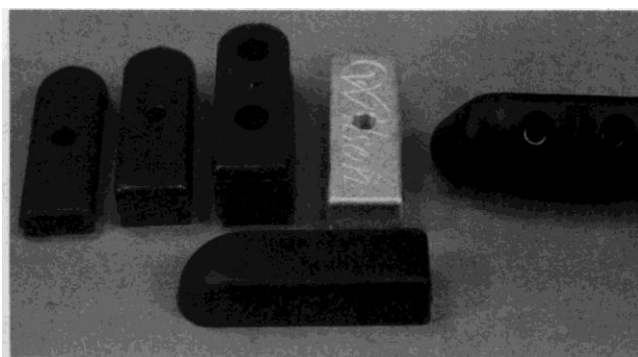
For magazines that are not drilled the procedure is still simple. Take your dial calipers and measure the width of the magazine. Divide this number in half, adjust your calipers and mark a line down the center of the baseplate. Measure the distance of the holes in the base pad from the front and the back and use the calipers to mark these distances on the centerline. Centerpunch the hole locations. Drill the holes with a #43 drill, and tap with your 4-40 tap. Install the basepads.

If basic black plastic is not what turns you on, the pads can be bought in a variety of colors, some not even found in nature. You can buy them in plastic, rubber, aluminum or brass. The metal basepads speed up your reloads a fraction of a second, as the extra weight gets the magazine out of the pistol a tad faster.

Basepads are also available for magazines that have removable baseplates. The early Wilson basepads were made of a plastic that would crack after six months of hard use, and I ended up replacing my plastic ones with brass. The newest formulation of plastic Wilson uses shows no signs of cracking and comes in a variety of colors.



Magazine base pads come in a variety of colors and materials. The left one is black aluminum, the next is black plastic, the center one is black rubber, the second from the right is bright yellow rubber, and the right-hand one is brass. Only the first one increases capacity.



Wilson's makes magazine buffers in various thicknesses, and both slide-on for their magazines and screw-on for others.



With the law limiting magazines to only 10 rounds, it was a natural for 1911 magazines to expand up to the maximum. The Mec-Gar mag comes bare of base pad. The Ed Brown magazine has both a base pad and a front bar that limits upward insertion. The Wilson magazine has only two view holes, at five and 10 rounds. The McCormick magazine has a large rubber boot that acts as base pad and grip extension.



Not only must current-production magazines not hold more than 10 rounds, they have to be difficult to modify. The Pachmayr magazine on the left is split and dimpled. If you drill out the dimple the magazine will fall apart. The Mec-Gar has a short steel tube and a long plastic base. The Beretta has a large crease in each side. The magazine on the right is an older, fifteen shot one.

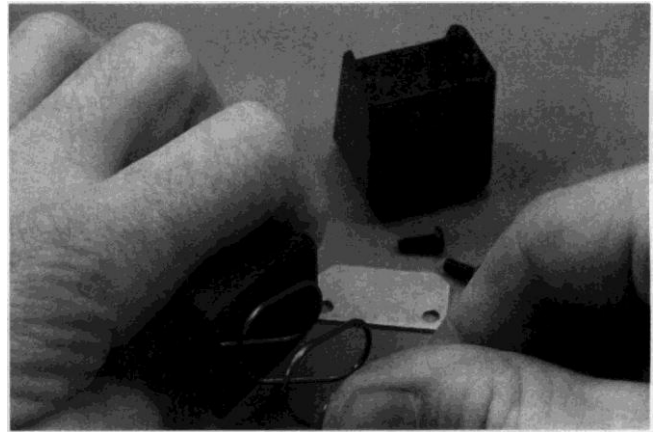
Capacity

Current legislation prohibits manufacturers from making new magazines with a capacity greater than 10 rounds. Existing high-capacity magazines can still be bought, sold and traded. For a while, prices skyrocketed. At the peak, a high-capacity magazine for a Glock went for one-quarter of the cost of the handgun itself!

As shooters became used to the idea of “only” 10 rounds per magazine prices stabilized. Some of the lesser-capacity magazines were re-designed to hold 10. The 1911 was the first. You can now buy 10-round magazines from Wilson, McCormick and Ed Brown. There are even 10-round magazines available for the little Colt .380!



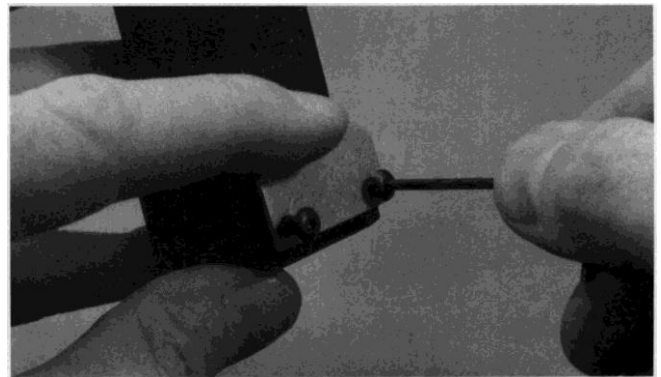
The Taylor Freelance floor plate for Glock's also includes a new magazine spring. This plate increases capacity by four rounds.



(1) Compress the spring.



(2) Keep the spring compressed while you slide the new bottom on.



(3) Screw the retaining plate on the Taylor Freelance, and your magazine now holds four more rounds.

The previously high-capacity magazines were redesigned to hold only 10 rounds. The redesign also made it impossible to increase their capacity. You should not try to circumvent this design limit.

It is illegal to increase the capacity of any magazine currently holding 10 or fewer rounds to hold more than 10 rounds.

It is not illegal to increase the capacity of a magazine that already holds more than 10 rounds. To this end, the makers of basepads make over-sized, hollow basepads. Depending on the pistol, the caliber, and the extension manufacturer, you can increase your capacity an additional two to eight rounds.

To install one of these baseplates, strip the magazine. Pull off the old baseplate. Some extensions (such as the CPMi) use the old spring, others do not. If you use the old parts, compress the spring, or spring and retainer, and slide the new extension onto the magazine rails. The CPMi extensions use a small screw at the back of the extension to keep the extension from sliding forward.

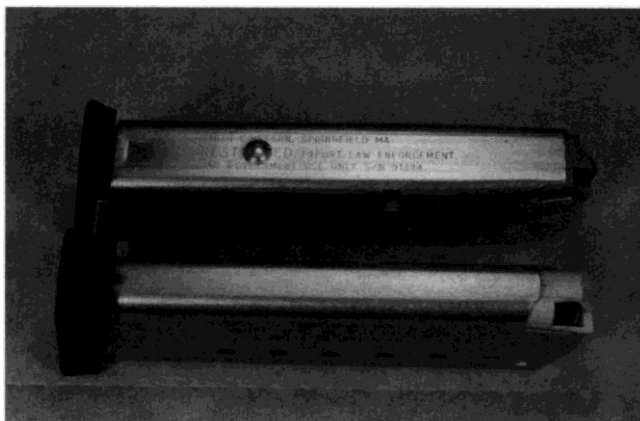
The Taylor Freelance Glock extensions use a pair of screws and an external retaining plate to keep the extension in place. The Glock +2 extensions sometimes pop off the magazine if they are bumped, launching bullets, spring and baseplate out onto the floor. The Taylor Freelance doesn't come off so easily, and you can get a +4 extension or a +8. The latter brings your Glock 17 up to a 25-round magazine!

If the conversion replaces the spring and retainer, pull the old parts out and save them in a plastic bag marked with the magazine type and number. The Arredondo extensions use a new retainer to keep the extension in place. Install this new retainer along with the new, longer spring.

If your high-capacity magazine becomes damaged you can probably replace the tube or have it repaired. You can buy replacement tubes for some brands. Other companies will repair or replace their tube, if you send them the old one. Still other manufacturers have made no provision for repair or replacement. It is against the law to use a replacement tube to assemble a new high-capacity magazine because you would be creating a magazine that did not exist before the law went into effect. The temptation to do so may be great. Resist the lure of illegal, new, high-cap mags.

The law still allows manufacturers to make high-capacity magazines, but these magazines are restricted for law enforcement, military or export use only. They are clearly marked. If you end up possessing one you are in violation of the law, a federal felony. On the books, unlawfully owning one of these magazines is the same as owning an unregistered machine gun. It may end up that no one is ever prosecuted for unlawfully owning one of these magazines, but who wants to be the first?

Since the supply of high-capacity magazines is strictly limited, be extra careful in your maintenance of them.



High-capacity magazines made after the Crime Bill was signed are intended for law enforcement and military use only. They are so-marked. Possession of one of these magazines is a Federal felony. No matter how good the price is, pass on this magazine until the law is repealed or expires.

Chapter 13 - Sights To Steer By

Sights are essential for good shooting. This was not always held to be true. Even now there are still some writers who advocate “pointing” or “natural” shooting.

Before WWII, sights were very small, hard to see, and hard to use. Compared to today’s sights, they were practically non-existent. Since most handgun altercations were (and still are) at very close range, it was easy enough to ignore the all but useless sights and fire away.

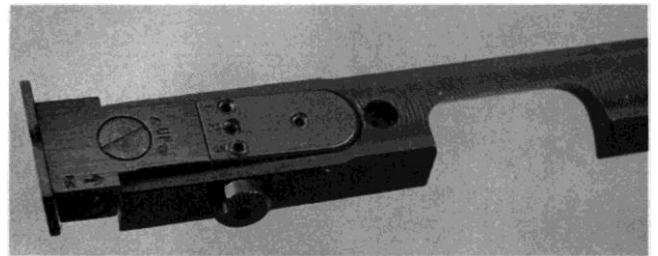
And fire away, and fire away, and fire away...

I mean, when you can read accounts of cowboys and gamblers literally running around a pool table shooting at each other, quitting only when they run out of ammunition, having hit no one—well, you have to assume that “pointing” had some drawbacks.

Sights have come a long way in the last 50 years. The surge of interest in handgun hunting and the heat of practical competition have proved the worth of sights. If you want to hit, you have to aim. What you aim with is your choice.



A sight rib is a common method of attaching sights to a slide for Bull's eye competition.



This Aristocrat sight rib has three settings to quickly change the rear sight for one of three distances.

Sights come in three types, fixed, adjustable and optical. Fixed and adjustable sights are referred to generically as “iron” sights. Despite their name, fixed sights can still be adjusted, though they require filing or welding, and drifting with a hammer and copper punch, to adjust. Adjustable sights can be moved with just a small screwdriver, and you can easily make incremental changes. A lot of shooters wonder why, if the fixed sights are so hard to adjust, they should use them.

Fixed sights are cheaper. They’re also more durable.

Some handgun manufacturers give you a choice of sighting systems. Some models of Smith & Wesson and Taurus can be purchased with fixed or adjustable sights. On other handguns, such as Sig, Beretta and Ruger, if you want adjustable sights you’ll have to install them yourself. Glocks can be found with adjustable sights, but these are a particularly fragile design.

Optical sights can be the traditional “scope”, a collection of magnifying lenses; or a “red dot” scope, which reflects a dot of light onto the lens of the tube; or a laser, projecting a beam of light to the target.

The scope is used mostly for hunting, where a small amount of magnification is useful, and milliseconds do not matter. With a 2X or 3X scope, a deer at 50 or 75 yards turns into a deer at 25 yards. You can take a deep breath, aim, and fire easily enough.

The red-dot scopes are mainly used for competition. Most are IX, or life-size; they offer no magnification. Since they require batteries, they are not as useful for hunting as traditional scopes. Sit patiently in a freezing cold hunting blind for a couple of hours with a red-dot scope and when you go to aim you’ll probably find those batteries have quit. In competition, however, with limited range and severe time pressures, red-dot scopes really make a difference.

Lasers are used mostly in the movies. Current laser technology creates a fragile sighting mechanism, with short-lived batteries and an inability to stay zeroed. The usual arrangement for turning a laser on — wires wrapped around the outside of laser and frame — leaves your handgun looking like some sort of cyborg. Clamping the laser to the frame typically leaves it exposed to all bumps, any one of which will jostle it right out of alignment. The hand-gun-laser assembly will not fit into a holster.

Early sights consisted of a small, rounded blade up front and a narrow and shallow notch in the rear. The design offered the shooter a view of a little bump, the front sight, resting in a shallow divot, the rear. There were no straight lines or right angles. Right after WWII Smith and Wesson began offering a sight design known as the Patridge. Others soon followed suit. The Patridge design changed the front sight to a flat-topped blade with straight sides. The rear was modified to a rectangular notch.

The new design would not hang up on the draw. It was easy to see, and extremely durable. Nonetheless, it still took a long time before the majority of handgun manufacturers offered it.

Using a Patridge design is simple. Line up the sights so the top edges of the front and rear sights are on a single line. The vertical “light lines” between the front blade and the rear notch should be even. Keep that alignment and press the trigger. You’ll hit the target.

The width of the light lines is a subject of some discussion. Bull’s eye shooters want the maximum precision available, and so prefer the smallest possible light lines. If their aim is off even the slightest amount, they can tell. Action shooters using iron sights will often ask for a rear notch that is wider than normal, and a narrower front sight. The result is larger light lines, but faster sight setup.

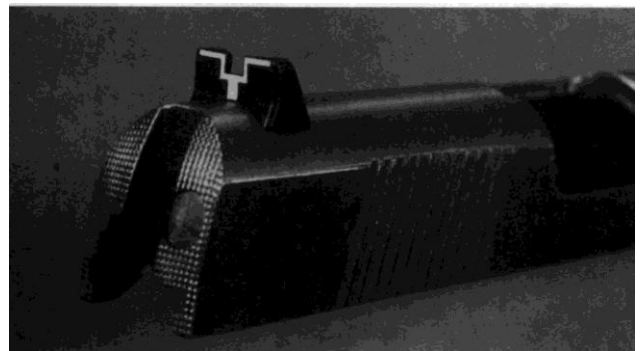
Sights used to come in only the same color as the rest of the handgun. If you bought a blued handgun, your sights were blue, if you bought a nickel handgun, your sights were nickel. Now, bars, dots and colors abound. Glock offers a white-dot front and a white-outline rear notch. Smith & Wesson has offered a red ramp front and a white outline rear for many years. Older handguns, or one that left the factory without these additions, can be brought up to date.

Today, even glow-in-the-dark radioactive night sights are available. In the daytime the sights seem to have simple white dots or bars on them. In darkness the dots or bars glow green, yellow, or red. You can still see your sights long after it has gotten too dark to identify your target.

As durable as your particular sights may be, they still are one of the more fragile parts of your handgun. Any handgun dropped on its sights will require repair.



The Novak rear on a Glock. It uses the standard-height front, and is available in three-dot and night sights.



This is a Millett fixed rear. The bar can be had in white or orange. If three-dot is your preferred style, that is also available along with plain black.

Measuring the location of your sights

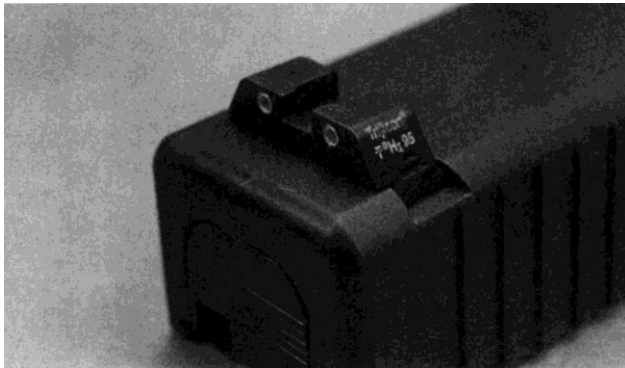
Any time you adjust your sights, you have to know where they were when you started, and where they ended up after you’re done.

For pistols, the height of front sights can be measured by simply using the end of your dial calipers as a depth gauge. To find out if your front sight is centered, take the slide off the frame, and place it on its side on a flat surface such as heavy plate glass. Measure up from the glass to the edge of the front sight blade. Turn the slide on its other side, and repeat. If the two measurements are the same, your sight is centered. If not, then take the difference between the two measurements and divide by two. The number you get is the distance for your adjustment.

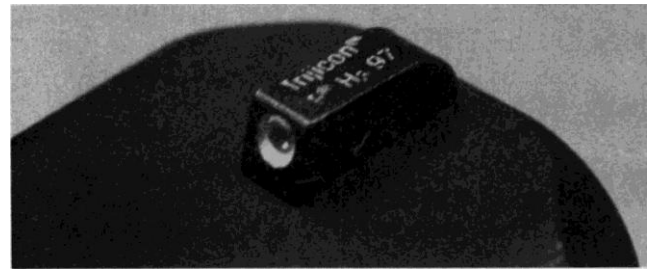
Measuring the rear sight height can be as easy as the front. If your rear is a simple blade, use the dial calipers as a depth gauge. To measure the height of adjustable sights such as the Bo-Mar or Millett, measure the height of the slide and the sight, then subtract the height of the slide, measured right in front of the sight. To find out if the rear sight is centered, use the same method as with the front sight.

Revolvers are not so easy. Though the front sight height can be measured with the dial calipers, using the same method as a pistol, the only way to find out if the front sight is centered is to shoot the revolver. If the sight is off-center, the group will be, too.

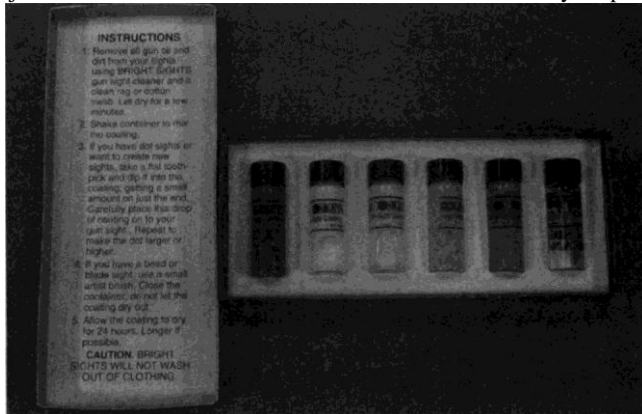
The height of the rear sight can only sometimes be measured. Many times there is just no place from which to check. Ditto finding out if the sight is centered. Again, you will have to take a revolver to the range, test fire it, and see if the sights are on.



The Trijicon rear is marked in the same manner as the Glock rear. If you need to adjust your group vertically, you get a different height rear. Get a Trijicon marked the same as the Glock rear that is zeroed on your pistol.



This is a Trijicon night sight. If you drop the pistol, or send the slide through a bluing solution, the tiny vial will crack and lose its Tritium. The sights will no longer glow.



The BrightSights paint comes in colors so bright you would swear there has to be a battery somewhere.



The BrightSights sight paint is formulated to be bright, and adhere to your sights.

Red Ramp insert

Your handgun has a plain front sight, and you want something different? First, look to see if the front sight is removable. Many are held in with cross pins, and some are built to fit in a dovetail on the barrel or slide. If you can remove your current sight, simply buying a new sight is the easiest way to upgrade.

When straightforward replacement is not possible, you will have to look into other methods of improvement. The simplest is paint. Degrease the sight. Use masking tape to protect the barrel from overspray. Select an appropriate color for your sight, but remember that whatever paint you choose will be darker on blue steel than it appears in the bottle or can. For many applications, I have found fluorescent orange works well. To keep the paint as bright as possible, first put on a coat of flat white. Follow this "primer" coat with a coat or two of your chosen color. If you use orange, which seems to be more fragile than other colors, protect it with a coat of flat clear.

Voila! You have a bright orange blade.

If you want just the surface facing you be a bright color, then the D&S Enterprise system of paints works better. In the standard kit, you get a selection of colors, some of which look brighter than you might think paint can be, without batteries. De-grease the sight, and brush the paint onto the ramp facing you.

Both of these painting methods will produce a front sight that will stand up to quite a bit of cleaning, as well as most solvents. But the method is not permanent. To make a permanent red ramp front sight, you will have to file a dovetail into the ramp, and cast colored epoxy into the dovetail. The kit offered by Kings Gun Works has everything you need in one box.

Start by marking the location you will file. The top edge of the insert must be even with the top edge of the sight, or your aiming point will be slightly lowered. Use the extra narrow swiss pillar file to file a notch in the sight. Then use a small safe-edge three-sided file to undercut the front and back edge of the notch, forming a dovetail. To give the epoxy casting greater strength, take a #48 drill and dimple the bottom of the dovetail you have filed.

De-grease the sight, and clamp the handgun in a padded vise so the notch is level. Clamp the Kings sight form around the front sight. Mix the epoxy, adding dye until the color looks right. Do not over stir, or whip, the epoxy, or you will force air bubbles into the mix. They will not all escape, and be left as voids in the epoxy when you finish the job. Use a toothpick to place drops of the epoxy into the notch, pushing them into the undercut ends, and the dimple, until there is a slight bubble above the level of the sight. Let the epoxy cure overnight.

The next day, remove your handgun from the clamp. Use your swiss pillar file, clean and un-chalked, to file the dome of epoxy level with the rest of the sight. If you find you have air bubbles, you can either clean the epoxy out of the dovetail and start over again, or use a flat clear paint to seal the epoxy.

You can clean the epoxy out and try again as many times as you want. While I have illustrated these methods with a Smith & Wesson revolver, all three will work on any pistol. They will also work no matter how your front sight is attached.



Kings makes an epoxy kit that lets you replace a tired orange front sight insert. You can also file a dovetail into your front sight and cast the epoxy into place.

Adjusting fixed-sights on a revolver

There are two directions to adjust on a sight — up and down, and left and right. Do not make vertical (up-down) adjustments until you have the revolver hitting on the centerline (horizontal, or left-right adjustments).

Adjusting horizontal is done by turning the barrel fractionally in or out of the frame. When you turn the barrel slightly tighter into the frame, you will move the bullet strike to the right. When you slightly unscrew the barrel, you will be moving the bullet strike to the left.

Before you start, examine the top of the barrel where it joins the frame. You need to record exactly how the two fit together before you make any adjustment. If the barrel is a smooth round cylinder, take a permanent marking pen and draw a straight line from barrel to frame. With a barrel that has a rib, or grooves on the top, make a drawing of just where the rib or lines match up with the frame.

Take the cylinder out of the frame. Clamp the barrel vertically in a padded vise, or in barrel blocks in the vise. Secure a frame wrench firmly around the frame. Depending on which adjustment you need, right or left, use the wrench to tighten or loosen the barrel slightly.

The amount you will adjust the barrel is very small. Make your first adjustment so the mark you are using as an index on the barrel/frame alignment is moved only $\cdot 010$ -inch. Take the revolver to the range and test fire it. Your group will be moved by the adjustment you made. Use the difference between the unadjusted and adjusted groups to determine how much more additional adjustment may be needed. As an example: your bullets had been striking 6-inches to the right, and you loosened the barrel $\cdot 010$ -inch. Now the bullets are only 2-inches to the right. A $\cdot 010$ -inch adjustment corrected $2/3$ of the error (4 of the 6 total inches). To correct the remaining $1/3$, or 2-inches, you need to make another adjustment of $\cdot 005$ -inch, or half the adjustment you already made. Setting up a simple proportion will help you calculate the adjustment with any set of numbers.

Vertical adjustment can be made only by filing the front sight to raise the bullets' impact, or welding more steel to the sight to lower the impact.

Except when you change barrels, you will rarely have to adjust the horizontal impact. You may have to “tweak” the new barrel back and forth a couple of times until the sights are dead-on. Filing the front sight for vertical adjustment is common only on single action Colt or Colt clone revolvers. On these the barrel is made with the front sight too tall. You file it to the correct height after adjusting horizontal impact. I have never had to adjust a Smith & Wesson barrel for vertical impact.

Old texts on pistolsmithing sometimes referred to a factory method, using lead bars, of adjusting point of impact on revolvers. The bars were made of a particular alloy, babbitt, and the factory assemblers would whack the frames or barrels of the revolvers with these bars, “adjusting” the point of impact as they waled away. If you want to go whacking your revolver with heavy lead bars, you are on your own. I would never do that to mine, nor will I ever suggest doing it to yours.

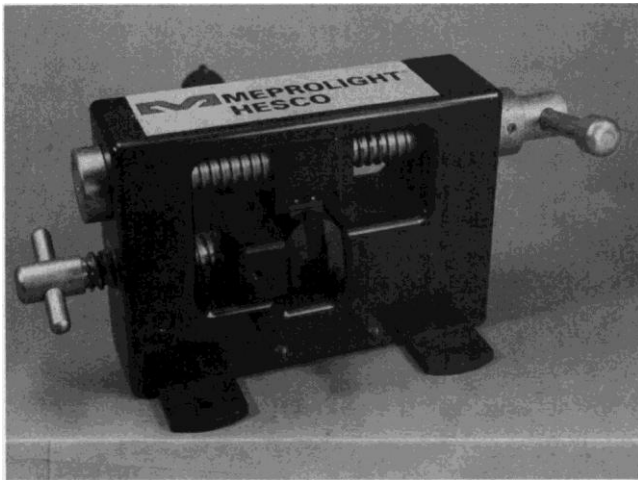
Adjusting fixed-sights on an automatic

To make horizontal adjustments on a pistol you move the rear sight. Use a brass or copper punch and a hammer, or an adjustment fixture. To move the bullet impact to the right, move the rear sight to the right. Move the sight to the left to move the bullet to the left.

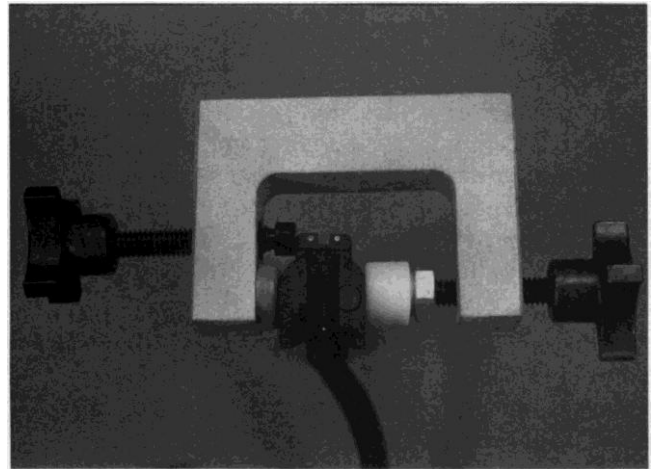
Unlike barrel turning, you can calculate the exact amount you have to move your pistol sight without trekking back and forth to the range. The ratio of the sight radius to the correction needed is the same as the ratio of the distance to the target and correction on the target. This is the same formula in Chapter 3, using a mill to adjust your sights, the sight correction divided by the sight radius equals the target error divided by the target distance.

For vertical adjustment, file the front sight to move the bullet impact up. Install a taller front sight to move the bullet impact down.

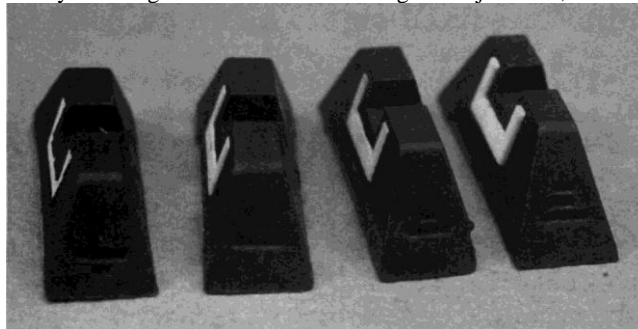
Glock makes vertical adjustment very easy, by offering their rear sights in a range of heights. If you find that your Glock is off vertically, check the side of your rear sight and find the line or lines cast into the plastic. The lines indicate the height of the sight. When you write to Glock for a replacement, tell them which model Glock you have, how far off your pistol is at what distance, and what your current sight says on the side. If you plan to own several Glocks, you can order one sight of each height, and then swap them around as needed.



The Hesco sight adjuster is so heavy and durable it makes some vises look flimsy. It is adjustable to handle a variety of handgun slides.



The Brownells sight pusher is not as heavy-duty as other sight pushers, but it gets the job done, and for a fraction of the cost.



Glock rear sights come in different heights. If you need to adjust your sights, get the next higher or lower sight and change the rear. The bars on the side indicate which is which. The standard sight has one bar. the shorter one has a smaller bar under the wide bar. The taller ones have shorter bars above the wide one.

Zeroing adjustable sights

The great advantage of adjustable sights is that you can adjust them with a screwdriver instead of a hammer. If you are at the range, simply “click” the sight until the point of impact coincides with the point of aim. Move the rear sight up to move the bullet up, and move the rear sight left to move the bullet to the left.

If you are at home and cannot test fire, use the equation above to calculate how much the rear sight has to be moved. Measure the location of the rear blade compared to a non-moving part of the handgun, then click the sight until you have moved the calculated amount.

Selecting sights

The job of your sights is to direct your aiming at the target, not distract you from that aiming. Purists feel that plain black sights are best for the job in the majority of situations. Not all shooters agree. There are situations in which your eyes can lose track of plain sights. When hunting in deep cover, for example, with trees and bushes providing shade, you might want a red ramp front and white outline rear.

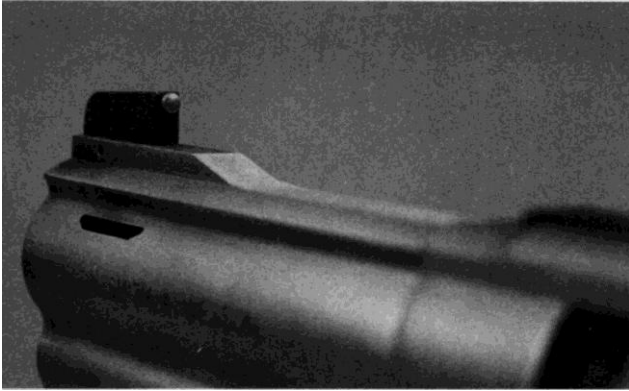
Do not assume that “perfect” sights are perfect for you. The handgun manufacturer ships firearms with sights that are great, but maybe not for you. The top shooter at your gun club may have selected the one, perfect, set of sights for his eyes, but they may be a poor choice for you and your shooting. In competition, especially, the color of the targets and the background can often dictate the best sight color.

So what are the choices out there?

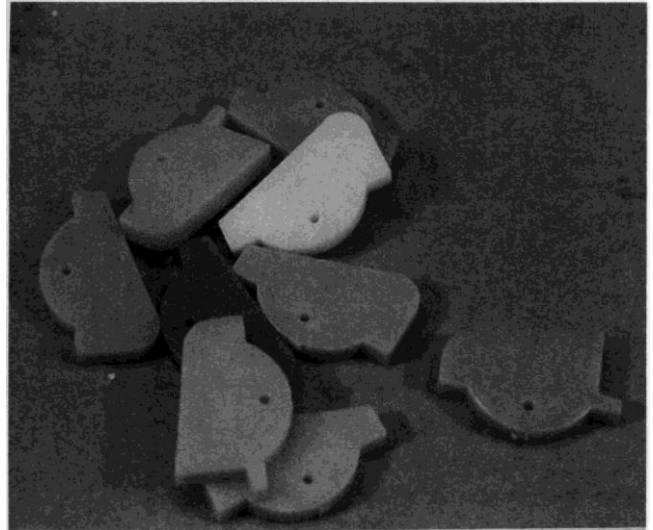
Besides a red ramp, Smith & Wesson and Novak both offer a front sight with a gold McGivern bead. Ed McGivern was a high-speed revolver shooter in the 1930's, whose times were neither matched nor surpassed until Jerry Miculek came along. Ed favored a plain black blade with a gold bead on it. While Jerry is faster than Ed ever was, he favors the same sights.

If you want color and lots of it, then Mag-na-Port offers replacement front sights that are all color. Made from a tough plastic, the whole blade is orange, red, green, blue or pink. You can shape the sight with a file, to make it a ramp or a post.

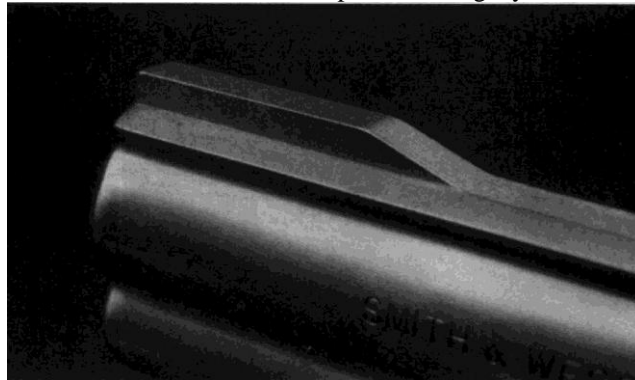
You can get sights in red, white and blue, with dots and bars (although no stars) and even glow in the dark sights. Use what improves your shooting, and don't be afraid to ask to try someone else's handgun to see what his sights are like.



The McGivern gold bead is favored by Jerry Miculek.



Mag-na-port offers front sight blades made of solid fluorescent plastic. Orange, yellow, blue, green and red.



This Smith & Wesson barrel does not have a sight cut of any kind. It can be milled to take either a S&W sight, or a Novak dovetail.

Installing sights

There are four ways front sights are attached to a handgun: (1) forged as part of the slide or barrel, (2) fitted in a dovetail, (3) staked to the slide, or (4) pinned to the slide or barrel. Rear sights are (a) attached as a permanent part of the frame or slide, (b) fitted in a dovetail, or (c) produced as part of an adjustable sight assembly. You must know how your sights are attached before you order any new ones.

A special note of caution when installing night sights: handguns with permanently attached sights must be shipped to the night sight manufacturer for installation. It is therefore especially important that you know how your sights are attached in order to purchase the correct replacements.

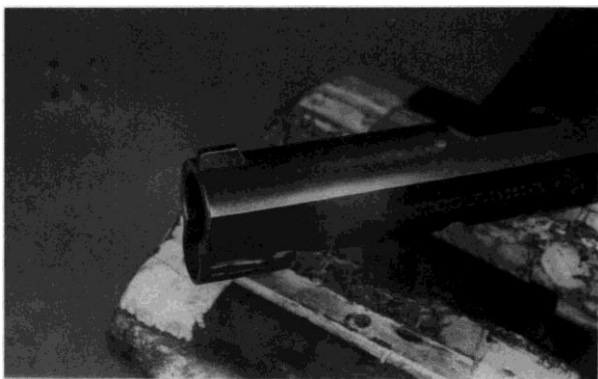
Front sights

(1) Permanent

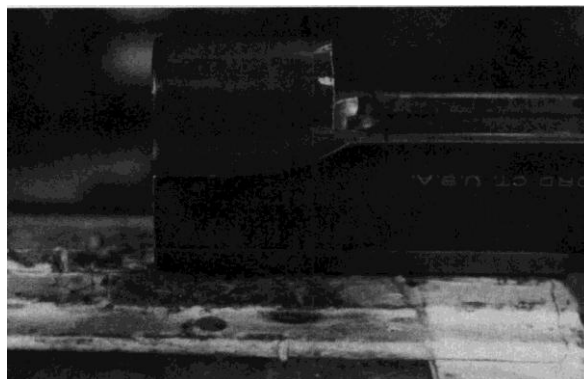
Permanent front sights can be found on fixed-sight revolvers, some Smith & Wesson pistols, and Beretta and Taurus pistols. These can be painted, or if the blade is large enough you can send them off to the night sight manufacturer to have the blade drilled for the tritium insert. If your front sight is not .125" wide, it cannot be drilled.

If you are repairing a permanent front sight you can weld it.

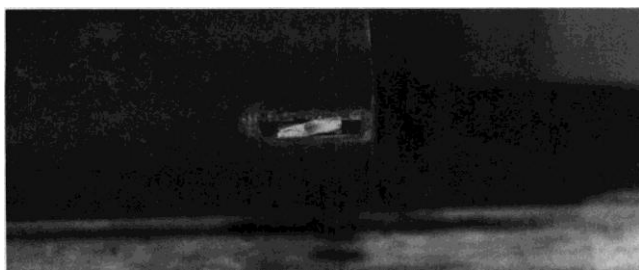
Replacing a fixed front sight on a revolver requires a milling machine. You will have to mill the barrel for either the Clark or Novak dovetail, fit the sight, and then shoot the handgun to fine-tune the front sight height.



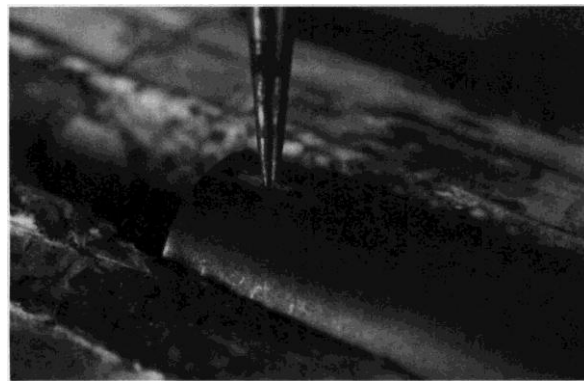
(1) A standard front sight, soon to be changed to a Millett Dual-Crimp front sight.



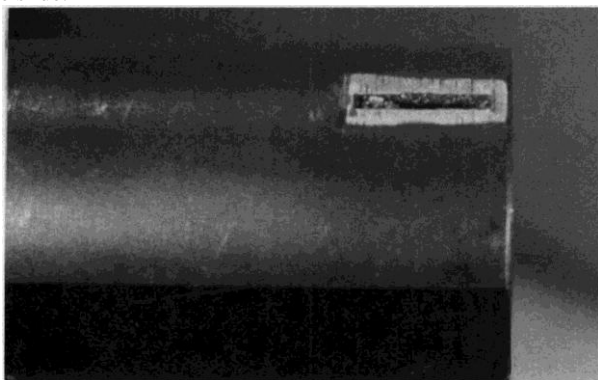
(2) Clamp the sight and rotate the slide break the old sight off.



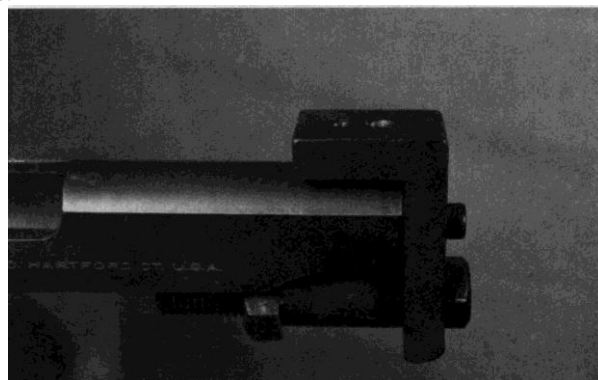
(3) The front sight broken free, sight in the vise and foot of the tenon still in the slide.



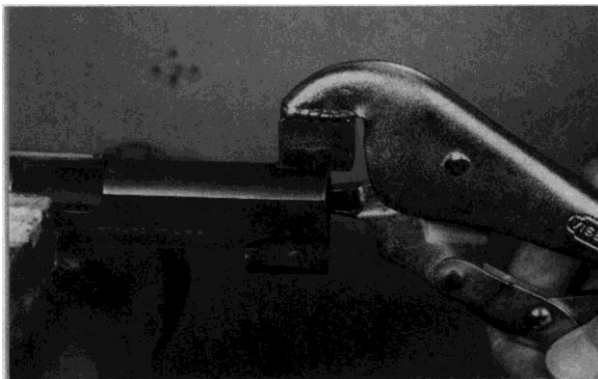
(4) Use a narrow tapered punch to drive the foot of the tenon out of the slide.



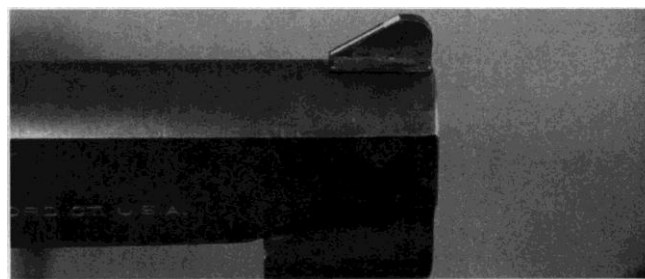
(5) Here is the standard front sight tenon after the sight has been removed.



(6) Clamp the drilling fixture to the slide, and drill the two holes with a carbide drill.



(7) Use the crimping tool to crimp the sight skirts into the beveled holes in the slide.



(8) Here is the Millett Dual-Crimp front sight attached to the slide.

When replacing a fixed front sight on a pistol, you can mill a dovetail, or on the case of the 1911, use the Millett Dual-Crimp system. To install the Dual-Crimp sight, use the fixture in the Dual-Crimp kit and drill a pair of holes through your slide. The two cups of the sight will fit these holes. With the Dual-Crimp tool, you then expand the skirts of the two cups on the sight, inside the slide. The older crimping tools would only expand the skirts of Dual-Crimp sights. The newer tools have replacement jaws, and can be used to stake regular 1911 sights.

Some pistols, such as the Beretta or Taurus, do not have enough metal at the front of the slide to mill for a new sight. You must either paint the existing sight or use a Millett Accurizer.

The Millett Accurizer sight fits over the regular blade, and is held on with a cross pin through a hole you drill through the old sight. The Accurizer has two set screws that bear against the barrel. As the action closes up, these two screws push the barrel into a consistent position in the front of the slide.

(2) Dovetail

Dovetailed front sights are easy. If your handgun came from the manufacturer with a dovetailed front sight, then you order a new sight for that model.

Custom 1911 slides are commonly made with a Novak front sight dovetail. Measure your current front sight, and order one the same height or taller. Use the brass drift and hammer, or a sight adjustment tool, to remove the old sight. Check the new one for fit. If it is too tight, use a safe-edge three-sided file on the dovetail extension of the sight until you can start it into the slide. Do not over-file the dovetail. If you make the fit loose, you have to either tighten the slot on the slide, or buy a new sight. To tighten the slot, use a centerpunch to punch a row of spots on the bottom center of the dovetail. If this is not enough to tighten the fit, use a steel drift punch and a ball peen hammer to bend down the top edges of the dovetail, **ONLY** in the center. The new front sight blade will cover the bends.

If this is still not enough, you must buy a new front sight and exercise more care in filing it to fit.

Once you can press the sight a third of the way into the slot, you are ready to use the hammer. Place the punch against the dovetail extension of the sight, and not on the sight body itself. If you pound on the sight itself you may bend it. In the case of night sights you may crack the tritium element in the sight, and lose that cheery night time glow.

Drift the sights until it is on the centerline of the slide. Range trip and test fire to determine that you have the handgun zeroed. If not, make the necessary calculations and then adjust.



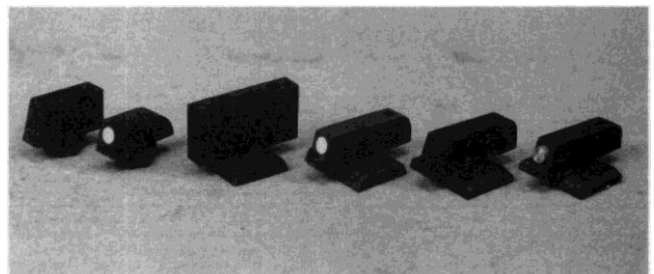
This is the Novak dovetail for a front sight.



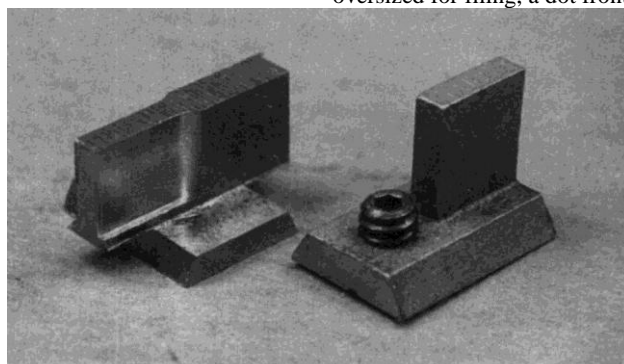
File sight until you can press it a third in with your fingers.



Once the Novak sight will finger-press a third or half of the way in, use a brass drift punch and a hammer to drift it the rest of the way.



A selection of Novak front sights. From the left, an oversized Glock sight ready to be trimmed down, a Glock dot standard height, a 1911 oversized for filing, a dot front, a plain front and a gold-bead front.



The Novak-style sight on the left uses a cross-ways dovetail slot. The Clark-style sight on the right uses a dovetail in line with the barrel.

(3) Staked

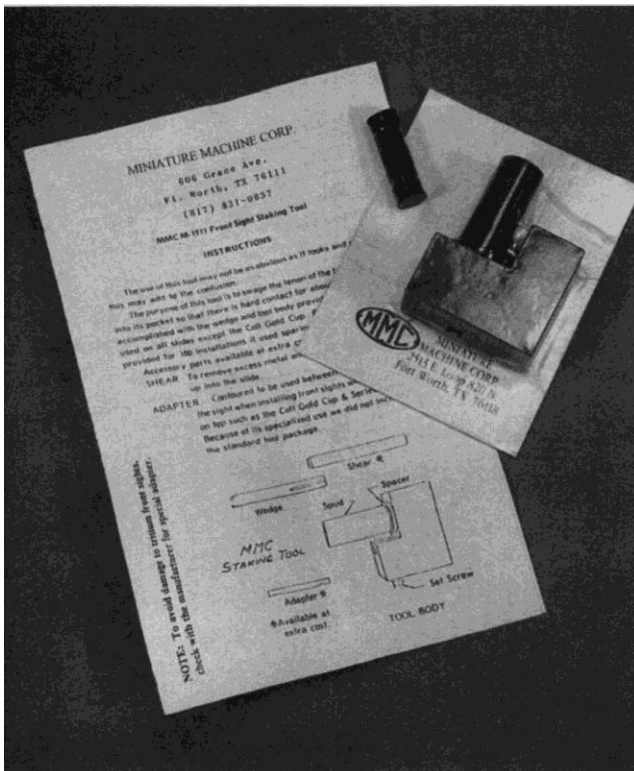
In this category you will find all 1911's that still have their original front sight tenon arrangement.

The easy way to remove the old sight is to clamp it in the vise, and turn the slide to twist the sight, breaking it from the tenon. Use a tapered punch to drive the tenon out of the slide.

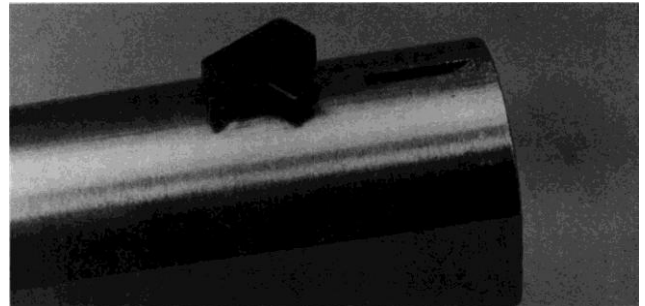
To put the new sight in, you need a front sight staking tool. The MMC fixture, which is the best, clamps the front sight against the slide. Driving the staking bar into the fixture peens the foot of the tenon. The peened end of the tenon expands into its slot on the slide, holding the sight in place. As mentioned earlier, there are three tenon sizes. Measure yours before ordering a new one, or it will not fit.

When installing night sights, if you simply clamp the front sight using the standard locking screw and brass shim, you will crack the tritium element in the front sight. No tritium, no glow. To allow clamping without cracking, front night sights have two wings on them. If your staking tool predates the introduction of night sights, you will have to make an adapter. File a small piece of steel so it fits into the tool. Then file a slot in this piece of steel, so it ends up in a U shape. The U takes the place of the brass shim. When you put the feet of the U on the wings of the front sight the bottom of the U must clear the front sight blade.

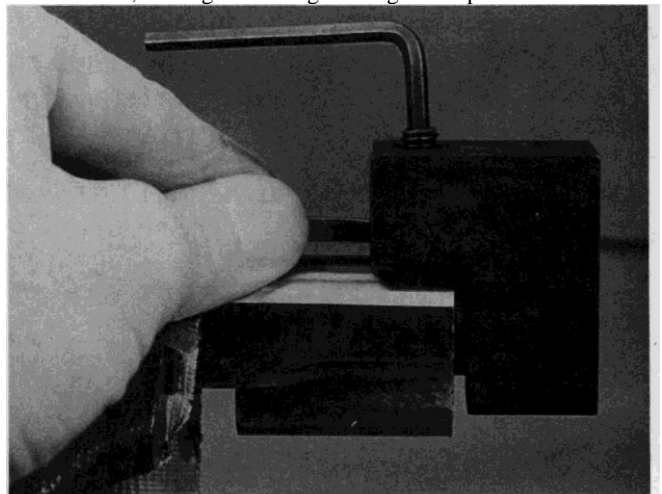
Clamp the sight against the slide with the U upside-down, holding the wings in place. You can now stake without crushing the tritium element.



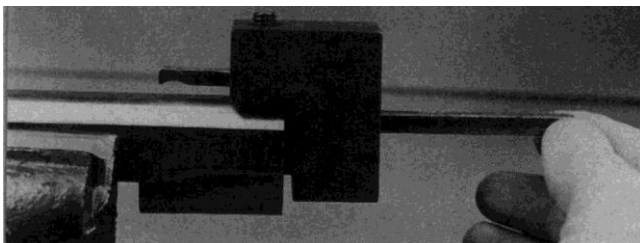
The MMC front sight staking tool comes with complete instructions and a tube of high-pressure grease. Use the grease or you risk wedging the shearing bar in your tool and will not be able to remove it.



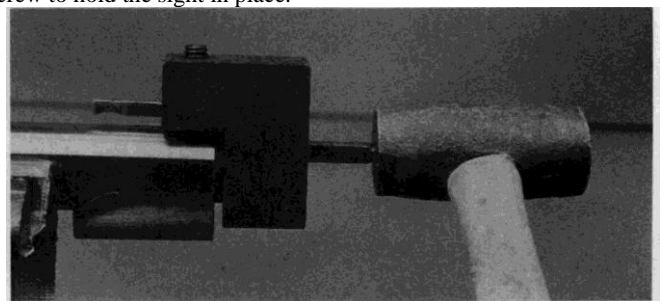
The traditional front sight on a 1911 has a tenon that sticks through a slot cut in the slide. The tenon fits into the slot, and the bottom of the tenon, inside the slide, is swaged to wedge the sight into place.



Once the sight is inserted in the slot, the MMC swaging tool is placed on the slide, and the sight protector is placed onto the sight. Tighten the top screw to hold the sight in place.



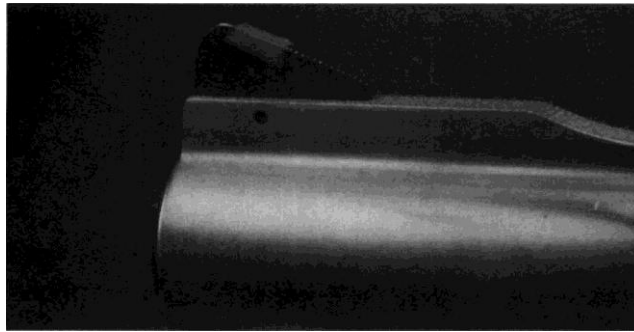
Place the swaging bar into the fixture.



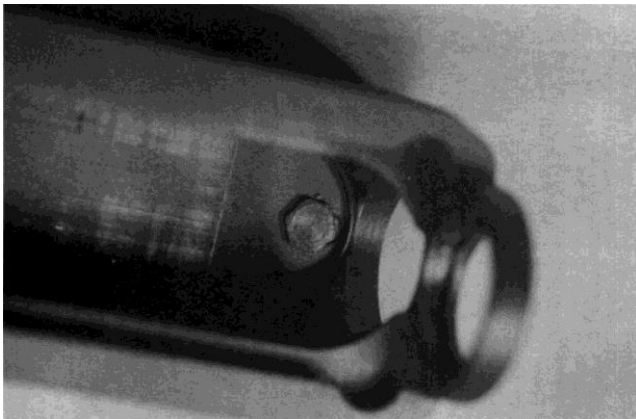
And drive the swaging bar through the fixture.

(4) Pinned

Some Smith & Wesson revolvers and Ruger pistols will have the front sight pinned to the barrel or slide. To change it, drive these pins out. Check the new front for fit and file the extension if necessary. Check the hole size on the handgun, and select a drill of the same size. Press the sight in place in the slot, and then clamp the barrel or slide in your drill press vise. Drill through the sight using the pre-existing hole as a guide. Drift the pin or pins back in place.



This Smith & Wesson front sight is pinned to the barrel. It can be easily replaced. Some sights are an integral part of the barrel and are not easy to replace.



Here is a Glock with a replacement front sight, showing the sight nut. This nut must be tight, and locked in place with a thread-sealer, or it will shoot loose.



To remove the old Glock front, use a sharp dental pick to pry the wedge out of the sight.

Rear Sights

(a) Permanent

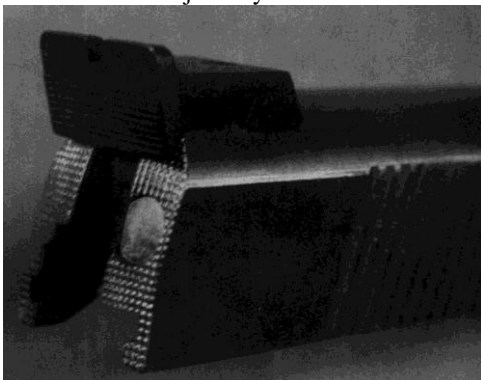
Installing an adjustable rear sight on a revolver with a fixed rear sight involves milling the rear of the frame. It is not reasonable, and in some cases not possible, to do this. The cost of obtaining the sights and either doing, or paying for, the milling can be more than the price jump to a revolver with adjustable sights. Many revolvers with fixed rear sights are rounded so much at the rear sight area of the frame that there is not enough steel in which to mill the sight slot.

If you have a fixed-sight revolver, and want the same one with adjustable sights, trade the old one in for a new one.

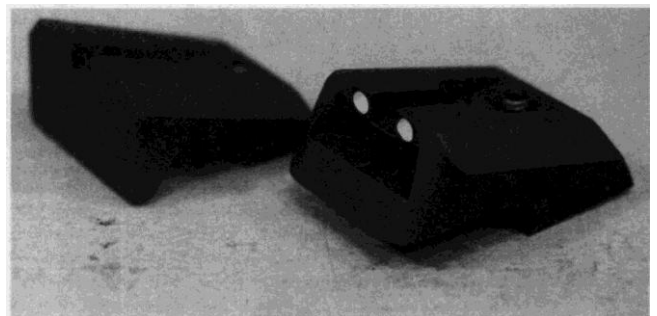
Permanent rear sights can have night sights installed, but only by the sight manufacturer.

(b) Dovetail

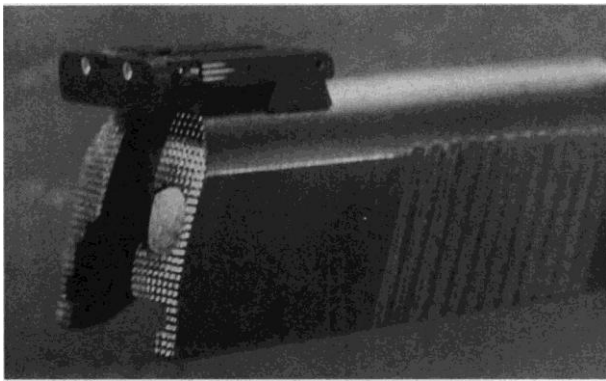
The dovetail rear sight is the easiest sight to swap. Drive out the old rear sight, fit the new rear sight by filing its dovetail, and drift it in place. Test-fire and adjust if you need to.



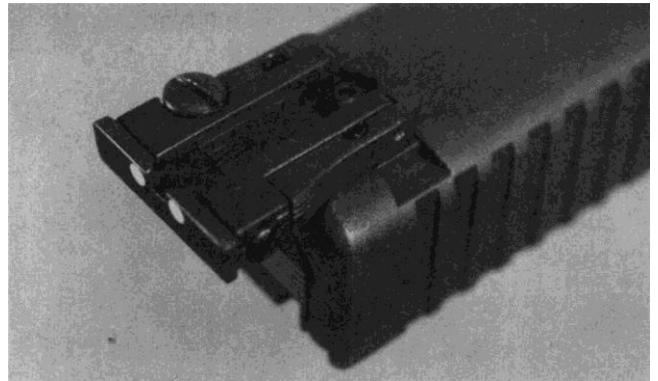
A Kings low-mount sight, this fits the standard 1911 rear dovetail and uses front sights .180 to .200-inches high.



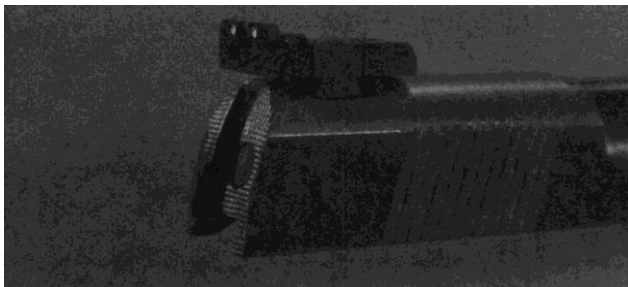
For shooters who do not want to have their slides milled, Novaks makes a high-mount rear sight (left). It fits the standard 1911 dovetail and uses a front sight from .180 to .200-inches high.



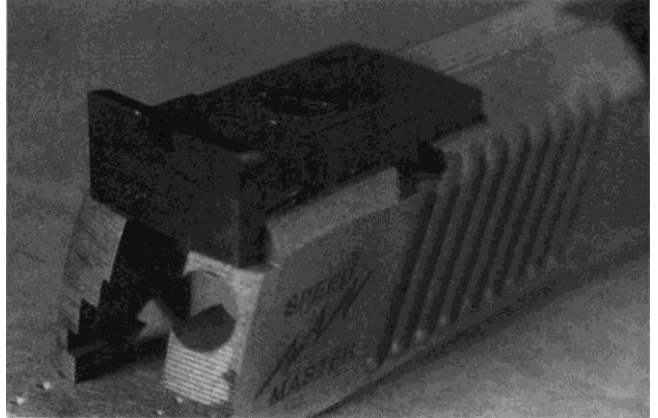
The Mec-Gar low adjustable sight uses the standard front sight on the Colt 1911.



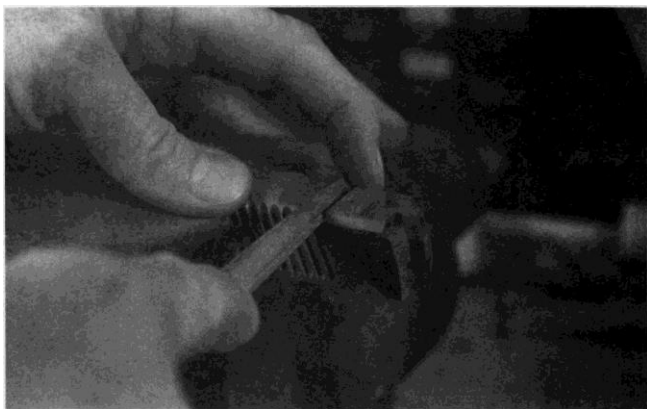
The Pachmayr adjustable rear sight on a Glock. It uses the standard-height front sight.



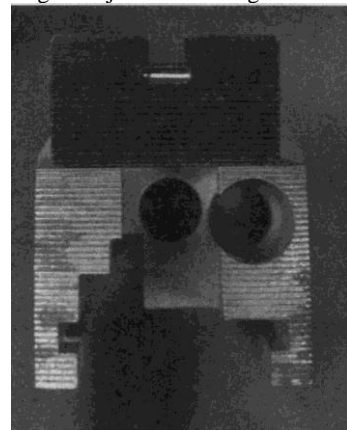
The Mec-Gar high adjustable requires a replacement front sight, higher than normal.



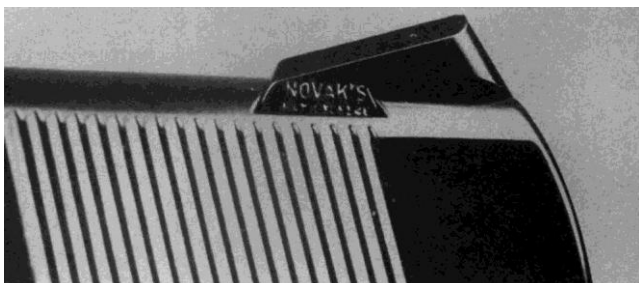
A standard Bo-Mar BMCS rear sight on a 1911 slide. A lower, more durable and more elegant adjustable rear sight cannot be found.



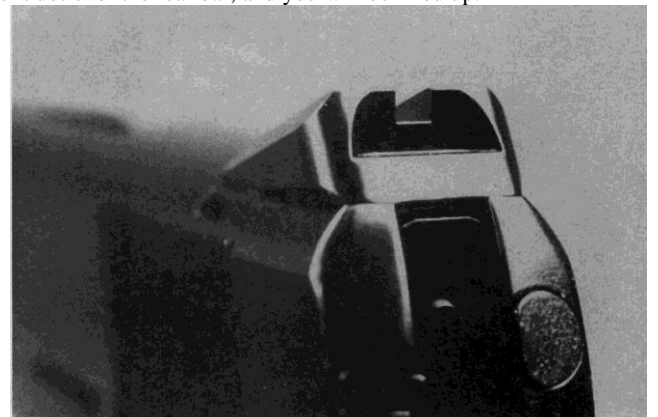
Use a safe-edge three sided file to adjust the new dovetail for a sight.



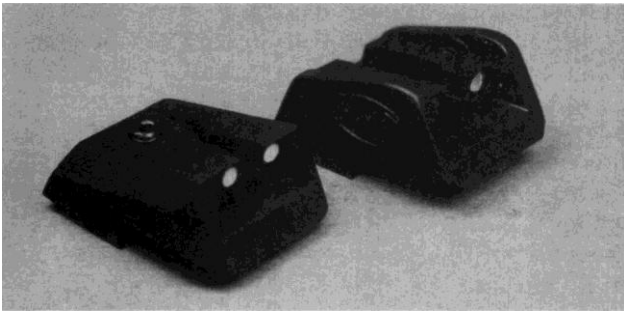
A Bo-Mar "bar-dot" night sight. Standard three-dot night sights can be misaligned when shooting. If you place the dots 1 -3-2 or 2-1-3 instead of 1 -2- 3, you will miss to the side. With the bar-dot, you place your front dot over the rear bar, and you will be lined up.



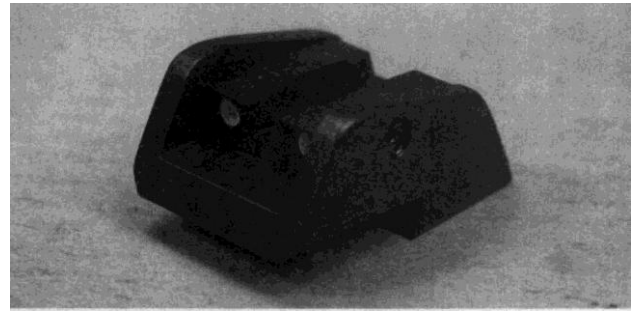
Here we see the distinctive wedge shape of the Novak low-mount rear sight.



The Novak low-mount rear sight from the shooter's viewpoint. You could almost use it as a hammer to drive nails, and not hurt it.



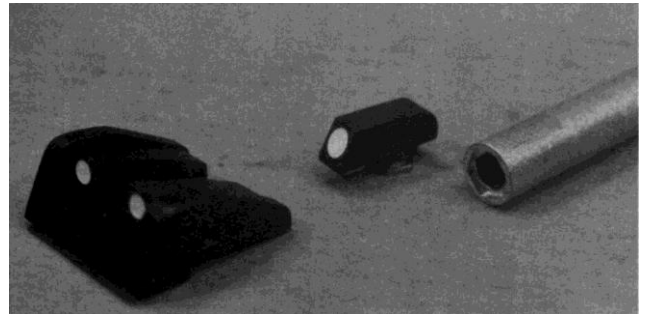
On the left the Novak low-mount, on the right an MMC adjustable. They fit the same dovetail on a 1911 slide.



The MMC adjustable sight for the 1911 fits in a Novak rear sight dovetail. Available plain, three dot or night sight, you have to mill your slide to install it.



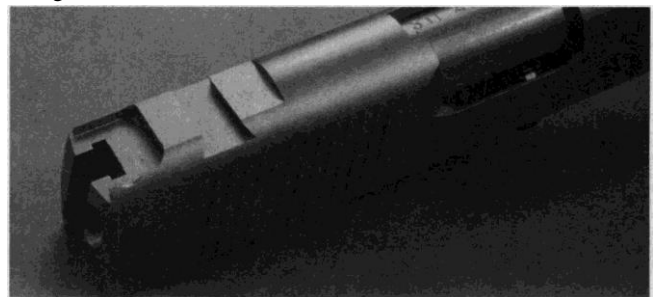
MMC adjustable sights are made for a variety of handguns.



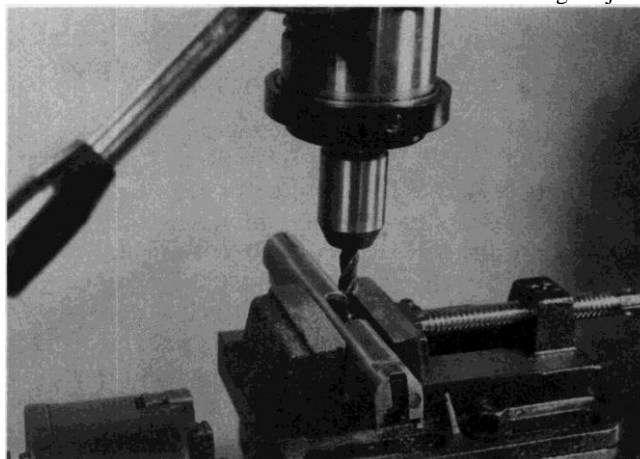
This MMC sight set for the Glock consists of an adjustable rear, a replacement front, and a special tool to turn the bolt that tightens the front sight nut.



The Speed Master slide includes the vertical adjustment screw hole. Slide your sight in, screw it down and it's off to the range.



The Bo-Mar rear sight dovetail requires several machining cuts. This "fenced" Bo-Mar cut is even more involved. The small rear sidewalls enclose the rear windage adjustment unit.



Here a slide is locked in the mill, ready to have a dovetail cut for a rear sight.

The King's and Novak Competition Hi-mount for the 1911 are fixed sights that will fit the dovetail with a little bit of filing, and still use the original front sight. That is, if the front sight is one of the latest production, at least .180-inch high. If you have one of the older Colts with a narrow little sliver of a sight, you'll have to change the front sight, too.

If you want an adjustable rear sight that uses the current front sight, then a low-mount rear such as the Mec-Gar or Pachmayr sights are just the ticket. In addition to the 1911, these are available for your Glock, Sig, Ruger or Smith & Wesson.

The Bo-Mar BMCS-2 fits into the standard rear dovetail of a 1911. However, where the Mec-Gar and Pachmayr sights use the standard front sight, the Bo-Mar requires a front sight that is .280-inch high, compared to the standard sight at .180-inch.

Another adjustable rear sight that fits into the standard dovetail is the Millett. The Millett needs an even taller front sight, .312-inch. If experience shows you that this taller front sight will not stay on your pistol, Millett makes front sights in their Dual-Crimp configuration. These do not come off of a pistol.

If you want a full-size rear sight that is adjustable, but does not use a higher than normal front sight, you will have to mill the rear of your slide.

This modification began with the early IPSC shooters. Bull's eye shooters didn't need a low-mounted sight. Their pistols sat in a hard pistol case until it was time to shoot at the range. The height of the sights, either in the case, or on the line, was not a problem. Unlike Bull's eye competitions, IPSC shooters had to start each string of fire from the holster. Drawing the customary undercut (and large) front blade would often leave ribbons of leather on the front sight, making shooting difficult. By milling the rear of the slide and mounting the rear sight lower, IPSC shooters could then use a lower front sight.

Shortly after lowering, shooters also began "melting" the rear sight. By beveling, or rounding, all the sharp edges of their sights, shooters found they no longer bled all over their pistols just from handling them.

Even though it is not adjustable, the Novak Low-mount rear sight requires milling. The sight itself is larger than a standard sight. Because it is lowered into the slide in a dovetail it does not require a higher front sight. The Novak rear dovetail was quickly accepted by shooters — so much so that Smith & Wesson had Wayne Novak design a set of rear sights for their pistols. These sights were proportioned to the slide of each series, so a small pistol would not have large sights, and vice versa. If you are replacing a rear sight of the Novak design with another Novak design, you must make sure you specify which handgun you have. Otherwise you could end up with the wrong one.

While they are strong, and can be drifted in their dovetail, the Novak sights are not adjustable. An adjustable sight that fits the Novak dovetail is the MMC. Rather than designing their own dovetail, MMC decided to take advantage of the wide acceptance of the Novak dovetail.

Another adjustable sight that requires milling is the Bo Mar. It uses a different dovetail than the Novak. The oldest adjustable sight still around for pistols, and used by many shooters, it requires more elaborate milling than the Novak dovetail does.

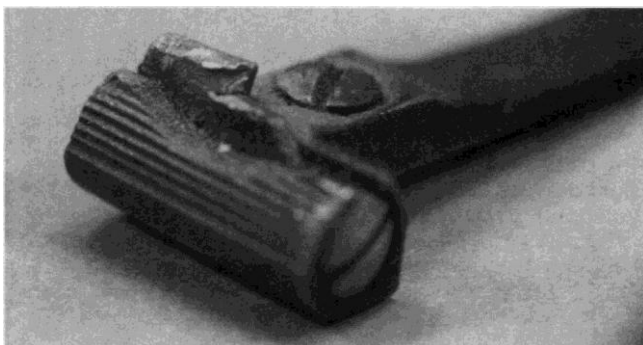
To low-mount the Millett adjustable sight you will have to mill a dovetail different from the others. You will be able to use a standard-height front sight with the Millett low-mount installation.

(c) Adjustable Assembly

If your pistol or revolver already has an adjustable rear sight, you can simply swap it for another assembly. To change a Smith & Wesson revolver from a plain black rear sight to a white outline, you only need to unscrew the front locking screw, slide the assembly out, and slide in a new Smith & Wesson or Millett sight. Handguns do not all use the same height rear blade. Be sure to specify the model, caliber and barrel length when ordering.

Rear sight replacement on the Smith & Wesson

Replacing the blade alone is less expensive than the whole assembly. If your rear sight is not damaged, but you want to replace the plain blade with a white outline one, the details are in Chapter 6.



If you drop your handgun you are likely to damage or break the sights.



Red-dot sights are very popular for competition, but battery performance in cold weather limits their use in hunting.

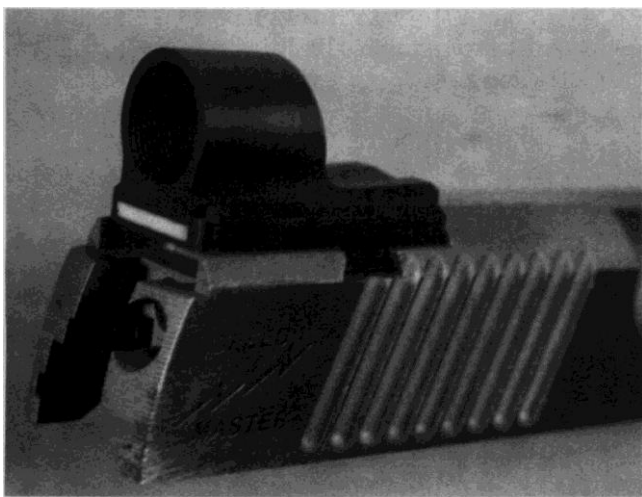
Recent developments in sights

Red-dot sights offer two great advantages over iron sights: much greater speed of shooting, and no loss of accuracy. These advantages are so marked the organizing bodies of handgun competition have had to split their matches into two categories, iron sights and optical.

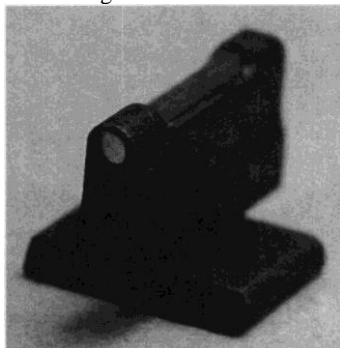
Being human, competitive shooters want sights that qualify as iron, but afford them the speed of optics. One of the disadvantages of iron sights is that they obscure the lower half of the target, slowing down aiming. If an iron sight could be designed that would not obscure the target, it would be a faster sight. Creative minds have been re-visiting the idea of sights, looking for a better iron design.

D. R. Middlebrooks has a nifty offering: a rear sight with a large ring, and a front sight that's a tall post with a bead on it. Inside the rear ring is a clear plastic disk with a small circle on it. At close range, say during an IPSC match, you put the front bead inside the rear ring, and don't worry about the small circle. For a precise shot, you place the bead inside the small circle. While it is available only to fit a Bo-Mar rear dovetail, D. R. Middlebrooks is working on other dovetail dimensions. Matt Waki began by modifying the Bo-mar rear sight until he ended up with just a skeleton. The Matt Waki Combat sight has a rear blade that's been slotted, to let you see the target, but retains the edges needed to align the front and rear sight. While the Waki sight can be used with a regular front blade, you can gain even more speed by using a front sight with a dot or bead on it. Rather than slot steel blades for a Bo-mar sight base, Matt simply molds his sights out of a durable plastic.

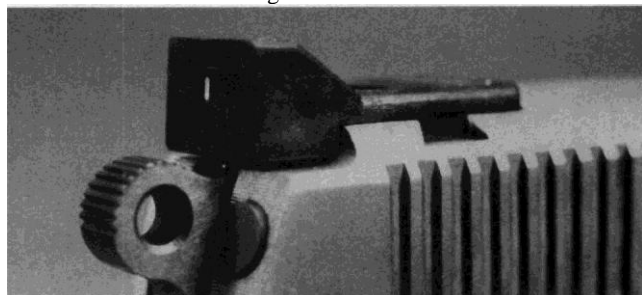
To install either of these sights, simply unscrew the Bo-mar adjustment screw and lift up the hinged half of the sight. Unscrew the locking screw and slide the old sight off. Slide the new one on, and secure the holding screw. You will definitely need a higher front sight for the Middlebrooks sight. The Waki sight may not need a new front, unless you want to try a front sight with a dot for greater speed.



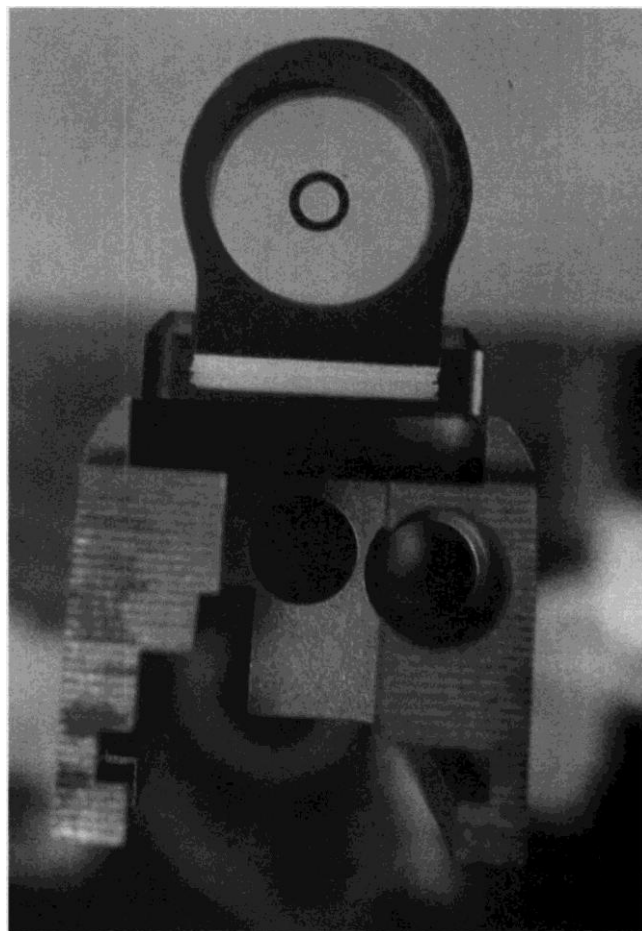
The Middlebrooks sight fits a standard Bo-Mar dovetail.



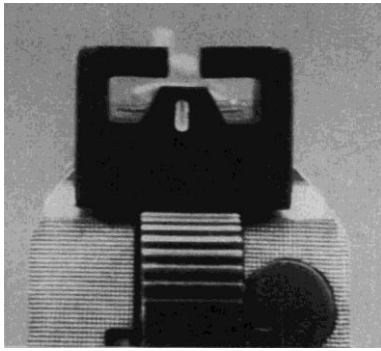
The Middlebrooks front sight fits a standard Novak dovetail cut.



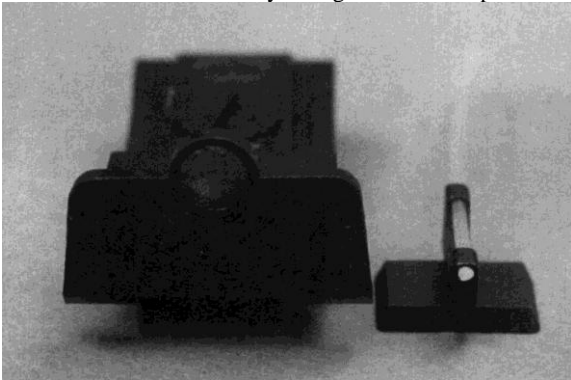
The Waki Combat sight from Matt Waki. It fits the Bo-Mar dovetail without fences.



The shooters-view of the Middlebrooks sight. The front sight is a fluorescent dot. Place the dot in the ring, and your sights are lined up. Very fast, but still accurate.



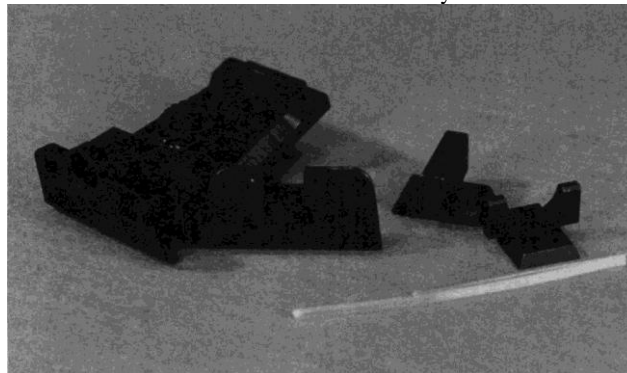
From the shooters viewpoint, the Waki sight is simple. Put the front dot at the center of the three bars and your sights are lined up.



The Caspian Race-Ready kit comes with two sights, one of which is their rear aperture/ front fluorescent bead.



If you want to use a laser sight, install one that replaces the recoil spring guide rod. Otherwise, the laser can be knocked out of alignment. The Lasermax units replace the guide rod, and on the Beretta, use a new disassembly lever as an on-off switch.



Caspian makes an aperture sight with fluorescent red or yellow tubes as a dot. You can swap the rear blade and front sight for a standard Patridge sight picture.

Optical Sights/Scopes

Used mainly for hunting with a revolver, a pistol scope, like a rifle scope, offers magnification and light-gathering. It differs in its size — it is much smaller than the usual rifle scope, befitting the smaller firearm it rests on — and in its eye relief. The term “eye relief” refers to the distance the scope has to be from your eye to allow a full field of view. Closer or farther away from the scope than the designed distance, you will see only a small circle of light. A rifle bears on your shoulder, and the receiver is only a few inches from your face. As a result, rifle scopes have an eye relief of around three inches. The handgun is fired at arms’ length, 24 inches from your face. At this distance a rifle scope is impossible to use.

Pistol scopes differ not just in eye relief, but in recoil resistance. Since the recoil of a full-power .44 Magnum handgun can be tougher on a scope than the recoil of a .30-06 on a rifle, it’s important to find a scope that can take the jolt. Because they have never failed me in any way, my two favorite handgun scopes are Leupold and Burris.

Optical Sights/Red dot

Used mainly by competitors, red-dot scopes offer a sighting system that is blindingly fast. With practice, they can be surprisingly accurate. With the red dot appearing to float in the shooter's field of view, there is nothing to block his (or her) view of the target. Without having to line up front sight, rear sight and the target, shooting is made much easier. The main difference between models is dot size. The dot, which appears only in the scope and not on the target, is measured by its apparent diameter at 100 yards. A "one minute" dot will appear to be 1 inch in diameter on a target 100 yards away. A "10 minute" dot will appear to be 10 inches, and this is not the largest size available. A shooter who is looking for the fastest sighting system will select a large dot. A shooter who is looking for precision will select a small dot.

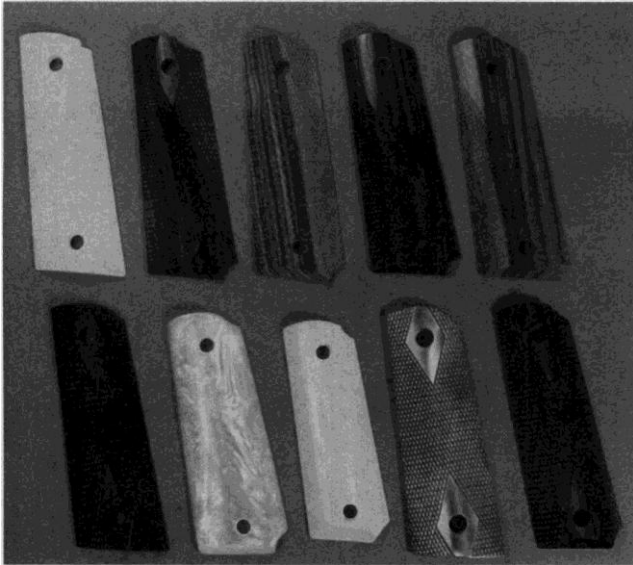
Optical Sights/Lasers

A laser is a beam of light where all the frequencies are the same, and all the individual waves are in lockstep. White light has the full rainbow of colors, lasers have only one — red. Why red? Because it is the frequency easiest to generate. Where the red-dot sights reflect the dot back to the shooter, the lasers actually project the beam to the target.

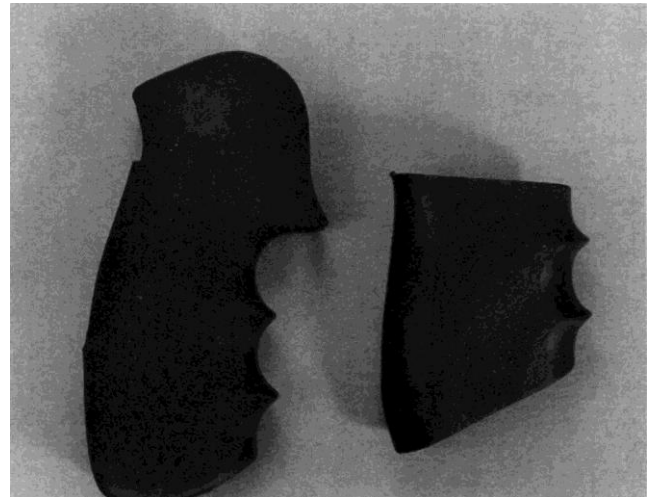
Laser sights have the same battery problem that red-dot sights have. They also suffer from the lack of a convenient mounting system. Most laser mounts leave your handgun looking like some sort of cyborg/mad scientist arrangement. Clamping a laser to your frame or trigger guard, you must snake wires around the frame to some place you can squeeze the "on" switch. Many mounts will not hold on tight, and many laser units will not stay zeroed even if the mount stays.

As a final stumbling block, many states will not allow hunters to use lasers, declaring them to be the same as flashlights in the hunting fields.

Chapter 14 – Grips



Top to bottom, left to right: An Ajax ivory-epoxy, Ahrends Rosewood, Ahrends Cocobolo, Ahrends French Green, Ahrends Cocobolo semi-checked, Navidrex Ebony, Ajax Pearl, Ajax smooth ivory-epoxy, Ajax pewter, Ajax rosewood.



Hogue makes Monogrips in rubber, and also slip-on grip adapters for all the common pistols.

You have to have some part of the handgun to grasp when you shoot. Luckily, handgun designers are aware of this and have created grips. Just one problem. Shooters still insist on having different sized and shaped hands. If we would all settle on a single hand size, the problem of correct grip design would solve itself. Not likely, I know.

Faced with the dilemma of different hands, pistol designers have created many types of grips for many types of hands. If you are not the proud possessor of an average hand, take heart; the variety and availability of handgun grips is legion. Look at grip/hand variation as an opportunity, and feel free to change grips to whatever feels good or looks good to you.

The material used in making grips (or stocks) is limited only by the imagination and skills of the person making them. Some of the better-known materials are wood, plastic, rubber, pearl, ivory, bone, horn, metal and micarta.

Easily shaped and modified, warm, durable, and comfortable to the hand, wood has always been the traditional grip material. Its many positives have only recently been overshadowed by cost and environmental considerations. Now, while some makers still turn out wood grips, many others have turned to rubber or plastic. Smith & Wesson, for example, no longer ships any handguns with wood grips. All their revolvers come with rubber grips. All their pistols have had plastic grips on them since the early 1980's.

When synthetic grips first came out, many shooters were cool to them. It was only after word spread about the comfort and recoil reduction of rubber that "basic black" grips gained acceptance.

Early wooden revolver grips were designed to be narrow at the top and wide at the bottom. The only way you could use them comfortably was by firing slowly with only one hand. Which, come to think of it, was the way most competitive shooters fired a handgun for the first eight decades of the 20th century.

The design was not useful or fun when shooting double-action, or using hard-kicking magnum loads. The grips tapered the wrong way. Heavy recoil caused them to slide right out of your hand, driving the muzzle upwards. When Smith & Wesson switched to rubber grips for their revolvers they reversed the taper. Now wide at the top and narrow at the bottom, with palm swells and finger grooves, most shooters can comfortably lock their hands to these grips.

If your grips don't fit you perfectly, there are minor variations in the dimensions and contours of the rubber grips from Smith, Pachmayr, Hogue and Uncle Mike. It is worth investigation to see if other members of your gun club have these grips on their guns, and try them out. You will greatly improve your shooting enjoyment with properly fitting grips.

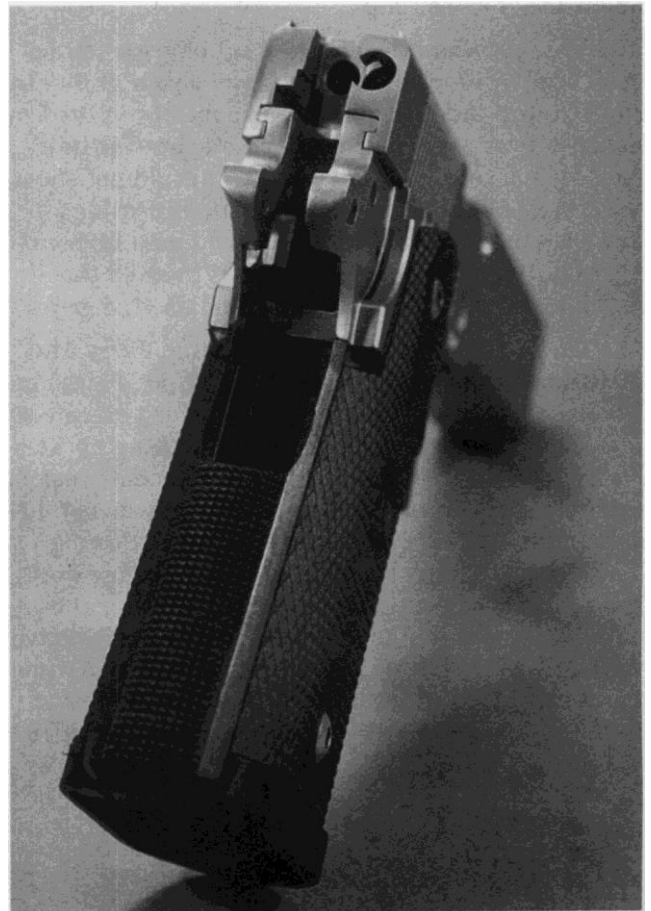
Pearl grips still suffer from the same social stigma that nickel once did. To quote General George S. Patton: “Only a pimp from a cheap New Orleans whorehouse would have pearl grips on his pistol!” The stigma does not keep shooters from buying pearl, or synthetic pearl grips. In some applications I must confess that even I can find pearl attractive. Real pearl is expensive and fragile. Synthetic pearl is neither.

Ivory was always the socially acceptable fancy grip material. Where a gentleman a century ago would never be seen with pearl grips on his pocket pistol, ivory was considered perfectly proper. Today ivory cannot be commercially imported into the United States. One of the few ways to get real ivory grips is to go on safari and shoot your own elephant. Have a part of the tusks turned into grips.

Manufacturers such as Hogue and Ajax offer ivory polymer. The sawdust and filings from ivory and bone are mixed with epoxy and cast into the shape of grips. It looks like ivory, it feels like ivory, but no one has to shoot an elephant to get it. With age and handling, real ivory will turn yellow. It will also crack, but not enough to weaken the grips. While the ivory polymer will yellow, it will not crack.



Hogue and Ajax both offer ivory-epoxy mix grips. They look and feel like the real thing, but at a fraction of the cost.

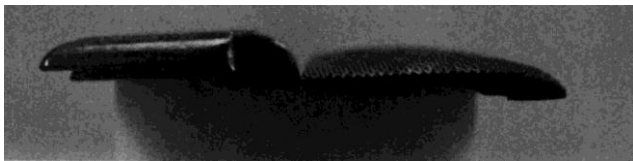


The checkering is cast right into the lower frame of this STI Short Block kit. It does not come with any internals besides the trigger. You have to install everything behind and above that.

Made out of antlers, stag grips have been a favorite choice for single-action revolvers for over a century. The surface offers a non-slip texture and a rustic look favored by quite a few shooters. I prefer them on a single-action. On a pistol I usually find them too thick for comfortable shooting, but if I could find stag grips thin enough I would use them. Their non-slip texture is as effective as checkering, and less prone to wear. If you want your pistol to feel larger and rounder, stag will do well for you.

Grips made of metal can be steel, brass or pewter. Metal grips add weight to the pistol, dampening recoil. They can be checkered, engraved, and even plated. Ajax offers pewter grips in several designs, and even gold-plates them on demand.

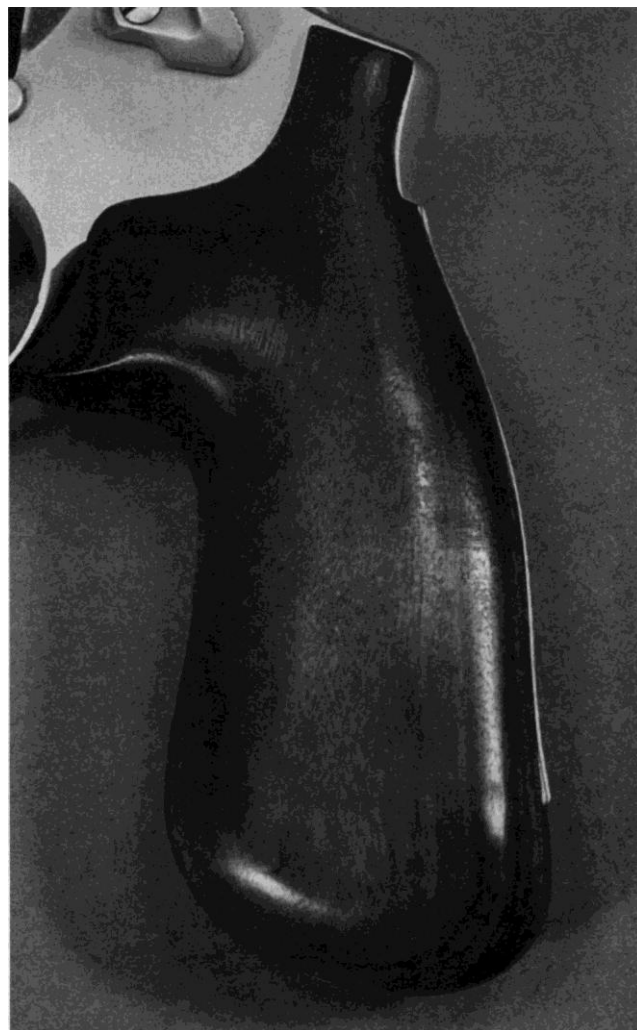
Micarta is the trademark name for a product manufactured by layering cloth or paper and saturating it with epoxy. The resulting product is tough, durable, and impervious to oils and solvents. It is easily shaped. By adding dye to the epoxy, micarta can be produced in all the colors of the rainbow. In an off-white color, Micarta can look like ivory, with much greater durability. In a jet black color, Micarta looks very much like ebony.



The Navidrex grips make a big difference on the Browning Hi-Power. On the left are the standard, portly grips. On the right are the Navidrex grips. Notice the difference in the thickness.



Here is the view underneath the grips, showing the shelf behind the trigger guard.



The Miculek grips do not have any checkering on them. The contours keep your hand in place.

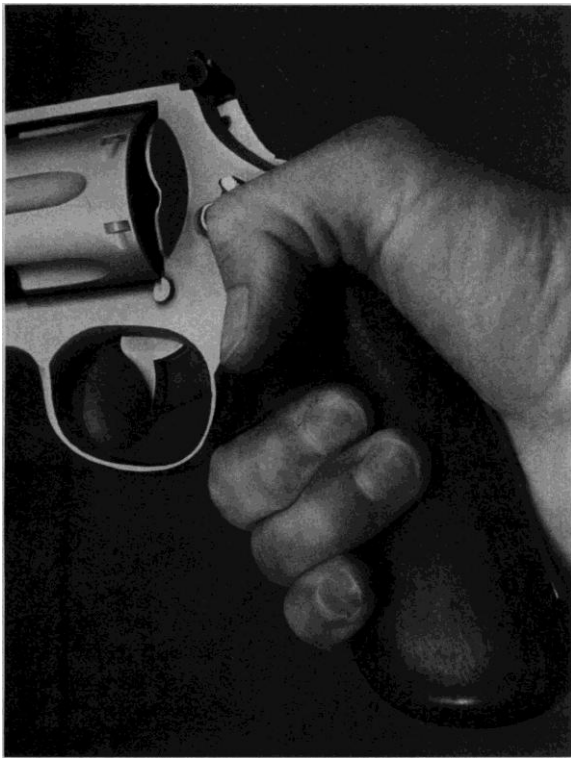
Some pistols do not have grips at all, or do not need the grips that are available for them. Many competition shooters remove the grips from their Para Ordnance or Caspian Hi-Cap frames, using only skateboard tape to provide a non-slip gripping surface. All the models of Glock pistols, the Ruger P-95, and the STI and SVI pistols have polymer frames or polymer-steel composite frames, and do not need grips. The non-slip checkering that would be on grips is cast right into the frame. What appear to be grip screws on the STI and SVI frames are not. The lower ones, if they are present at all, are purely cosmetic. The upper ones hold the plastic magazine housing to the upper (steel) rails assembly.

The checkering cast into the polymer is not aggressive enough for some shooters. As soon as the Glock appeared, shooters experimented with rubber bands and sections of inner tube, looking for a stickier surface or a more comfortable grip. When grip manufacturers saw this new market, they began offering cast rubber tubing to slip over the “grips” of these pistols.

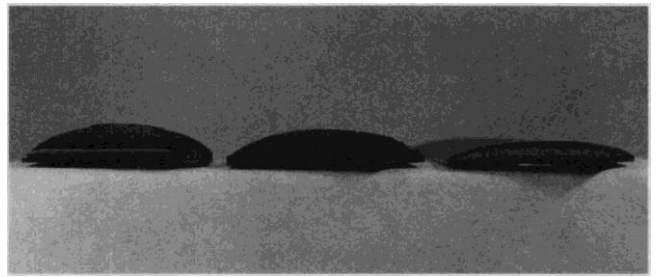
When buying replacement grips you should look for four things: performance, comfort, appearance and pride of ownership.

The performance of a given set of grips can be measured by how much they improve your ability to shoot your handgun. I find the shape of the Browning Hi-Power extremely comfortable, but the hammer used to bite my hand so badly I could not shoot the pistol. With Navidrex grips, the Browning Hi-Power became so comfortable to hold, and its pointing qualities were so improved that I solved the hammer-bite problem just so I could use the grips!

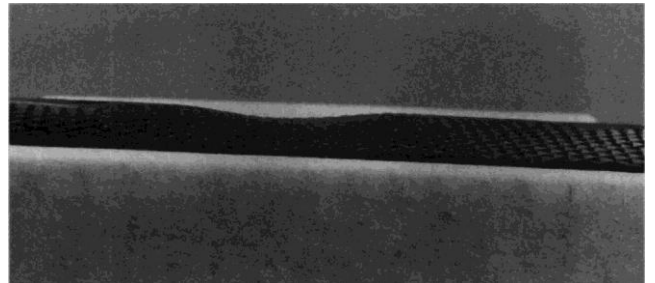
The World's Best Revolver Shooter, Jerry Miculek, has designed a set of revolver grips. Since Jerry can shoot a revolver so quickly, and so accurately, that most shooters with pistols cannot keep up with him, I thought it only prudent to try his new design the very nanosecond I heard of them. I was not disappointed. Like Navidrex grips on the Browning, Jerry's greatly improve the hand comfort and pointing qualities of the revolver. Gently curved, and without either taper or checkering, these grips have the curve behind the trigger guard filled with a wide, flat section. The filler protects your second finger from the trigger guard under recoil, and the width gives the grip stability in your hand. Even though the grips do not have an apparent reverse taper to them, they do not slide to be useful, but once you through your hand under recoil. The smooth surface keeps the draw as fluid and fast as possible, though if you want you can checker it. But the most important thing about these grips? When I used them, my times improved noticeably. That's performance, and it's different for every shooter.



The Miculek grips provide a smooth surface for a fast draw, while the filler behind the trigger guard protects your second finger.



Grip thickness makes a difference in the pistols feel. The standard grips on the left, the Navidrex grips in the center, and the slimmest of all, the AFS Tech on the right.



Not only are the Navidrex grips thinner, they are sculpted. The Ebony Navidrex grips in front, compared to a standard pair of grips in the rear.

In the search for comfort, many shooters select grips that are too large for them. A grip that is too large often feels comfortable at first, but holding an overly-large grip will tire your hands quickly. Shooters with small hands have a particular problem-everything is too large, even before they try replacement grips.

With revolvers, shooters with smaller hands can select a model that has a round-butt frame. Smith & Wesson offers all their revolvers in a round-butt version. Ruger revolvers offer an even better chance at finding the proper grip size. Since the frame inside the grips is just a post, you can carve wood grips down without worrying about hitting the frame. Make them as small as you need. For the smallest size on other revolvers, select a "boot grip" design, intended for round-butt revolvers used in concealed carry. At first glance they appear entirely too small, find the right size for your hand, the design works very well. The subtleties of contour on a boot grip are very important. When you go to buy one, take your revolver along with you to the gunshop. Try every design available.

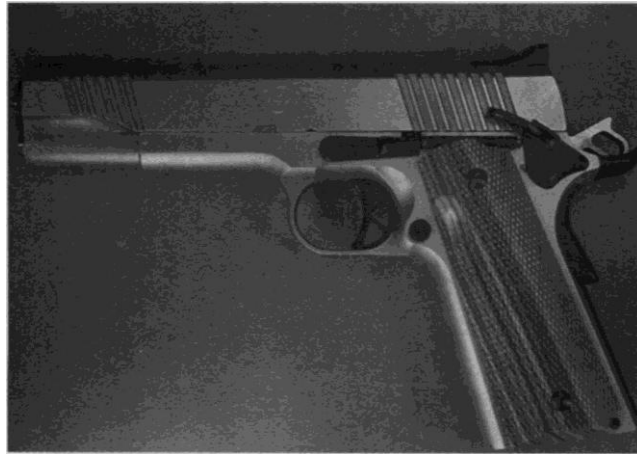


For small hands, a lowered thumb safety from Gunsite Custom Shop can make even a .45 manageable.

For pistols, you can select smaller than normal grips, or select a smaller pistol. Slimline grips are available for the 1911 from AFS Tech and Navidrex. The difference in size between these and standard grips is marked. I find it difficult to use a pistol with these grips. It doesn't sit quite right in my hand.

A smaller pistol usually means a smaller caliber. If you don't want to go to a smaller caliber, the only way I know to get a smaller pistol frame and keep the big caliber is through the Gunsite Custom Shop. They'll shave fractions of an inch off of the entire circumference of the grip area of the frame of a 1911, creating the Gunsite Custom Shop Slimline 1911. It is expensive and delicate surgery, and for most shooters slimmer grips will do nicely.

If you are looking for recoil reduction in your grips, Pachmayr makes their rubber grips out of a synthetic selected for its softness, Decelerator. On a rifle or shotgun recoil pad, Decelerator is amazingly soft and resilient. While the handgun grips are thinner than shotgun recoil pads, they work very well at taking the sting out of the recoil of magnum loads. The Decelerators are available for all the common designs and models.



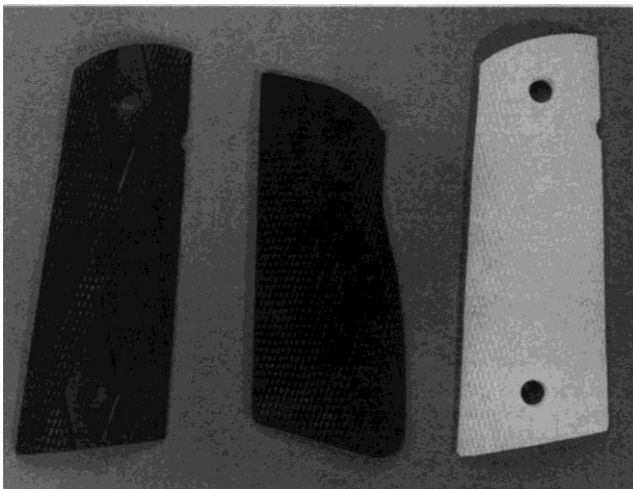
Nothing sets off an elegant pistol like a classy set of custom grips.

Appearance and pride of ownership are very important to some people, and not at all to others. I have gone through several shifts in my world view, and find myself now seriously considering exotic woods and ivory as being entirely suitable for grip material. Before the 1970's such choices were not even available, unless you happened to know both a source of exotic woods and a craftsman who could make grips for you.

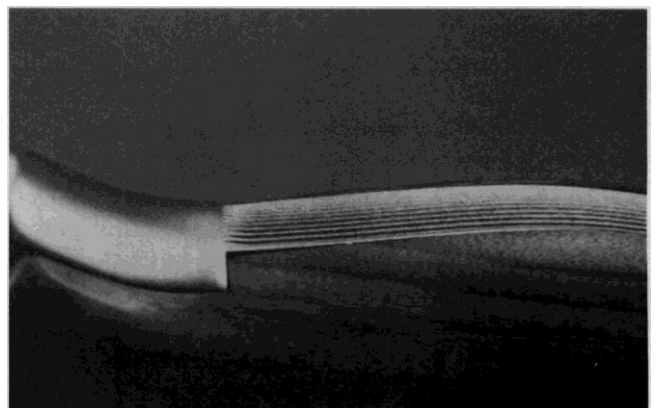
Now, you can get exotic wood grips from Bill Wilson and Kim Ahrends. Bill offers half a dozen different woods. Kim offers a dozen, and are they spectacular! Just reading the names gets you thinking about your handgun in a whole new way. There's Mayan Bloodwood, Pink Ivory, Snakewood, Lignum Vitae, to name a few.

How do you fit your grips to your handgun? In many cases, very easily.

Fitting most rubber grips, including Pachmayr, is as simple as falling off of a log. Remove the grip screws that hold your grips. Use Pachmayr's replacement screw to bolt on the replacement grips. Check to see that your new grips do not interfere with the hammer spur of your revolver. If you've put Pachmayr grips on a pistol, check the magazine catch and slide stop to see that the grips don't interfere with their function. If they do, use a razor blade or exacto-knife to slice away just enough rubber to provide clearance.

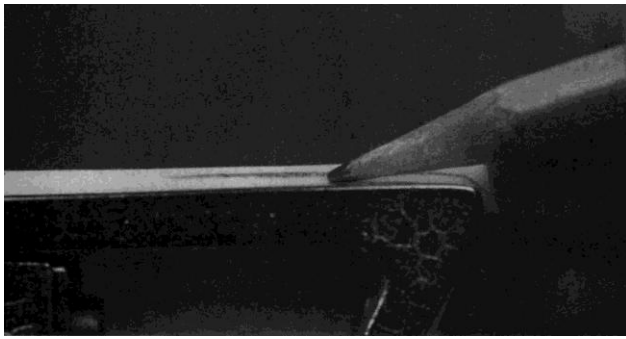


The black grips are Navidrex ebony grips, the white grip is an ivory-epoxy grip from Ajax.

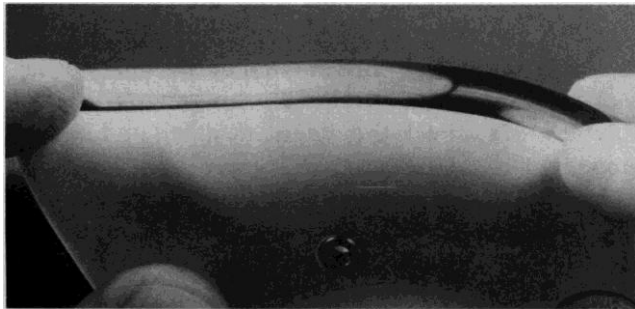


Here are a set of Hogue Monogrips that perfectly match the contours of the frame.

Pachmayr makes a line of grips that combine the comfort of rubber with the looks of wood. Fitting these, and other grips that leave the backstrap exposed, requires an additional step. After attaching them to the frame, check the fit of the grips to the backstrap. If the grips overlap the frame, the sharp edge will be very uncomfortable.



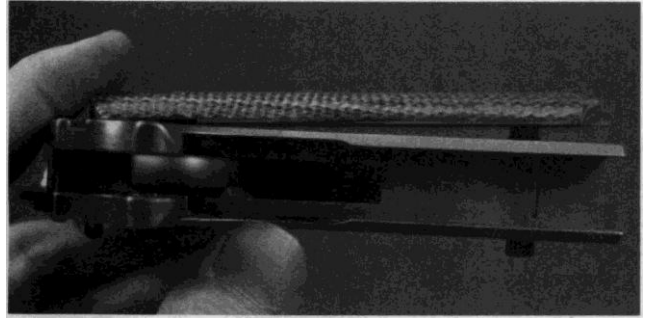
Hold the grips to the frame and mark the edge.



Once you have filed the grips to the line, they should not overlap the frame any more.



Clamp the grips in a padded vise and file to the line.



Sometimes your grips will not quite fit over the grip screw bushings. Use a carbide cutter in your hand-held grinder to provide clearance.

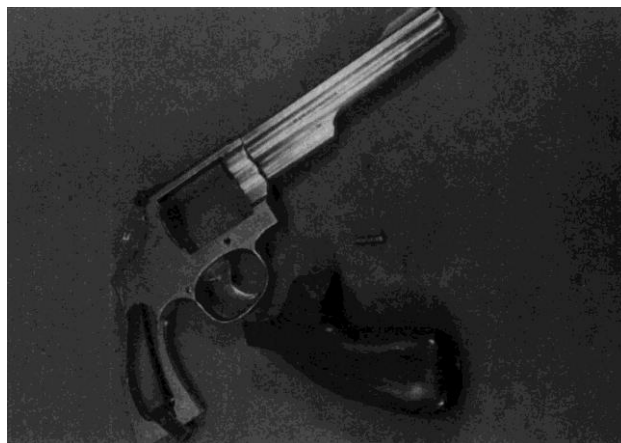
First, take a sharp pencil and mark the grips by following the edge of the frame, drawing on the exposed part of the grips. Take the grips off the revolver and clamp each panel in a padded vise. Carefully file the edges down to the pencil line you have drawn. There is no need to rush. Check the fit of the grips frequently, and gently file where needed. Once you have the grips almost fitted, use your 400 grit cloth backed with the file to sand the surface smooth and to a perfect fit.

You are done. Seal the wood.

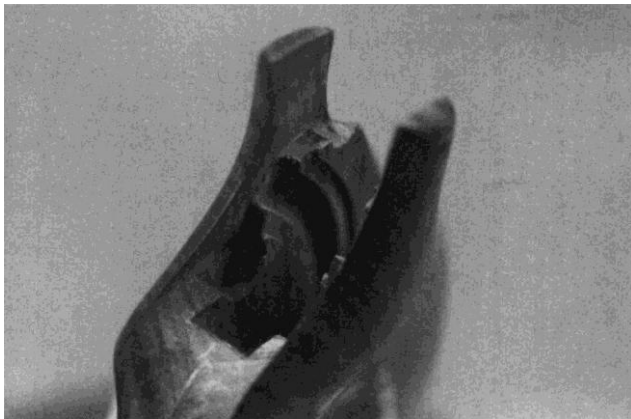
All grips for the 1911, and many other pistols, must fit over the grip screw bushings. Do not force tight-fitting grips into place. Wood grips, especially, are thin, and the extra stress may cause them to crack. Take new, tight-fitting grips off the pistol. Place the grip screws back in the bushings. Flip each grip panel around, placing the outside against the frame. Check the grip screws against the grip screw holes in the grip panel. If the holes are so far off that the one of the screwheads won't even clear the grip screw hole, send the grips back with a note about your problem. Use your dial calipers to determine the distance between the grip screw bushing centers, and send this information along with the note. The grip manufacturer can tell if your pistol needs grips with the holes custom-drilled, or if his grips are off.

If the grips are very close to fitting, and only need a little help, then you can modify them. Use a candle or match to smoke the grip screw bushing. Press the grip on the frame, and then pull it off and look for the carbon deposited on the grip. Use a half-round needle file to open the hole, so the grip can fit over the bushing. Once the grip slides over the main part of the bushing, use your hand-held grinder with a carbide cutter to open the relief cut on the back of the grips.

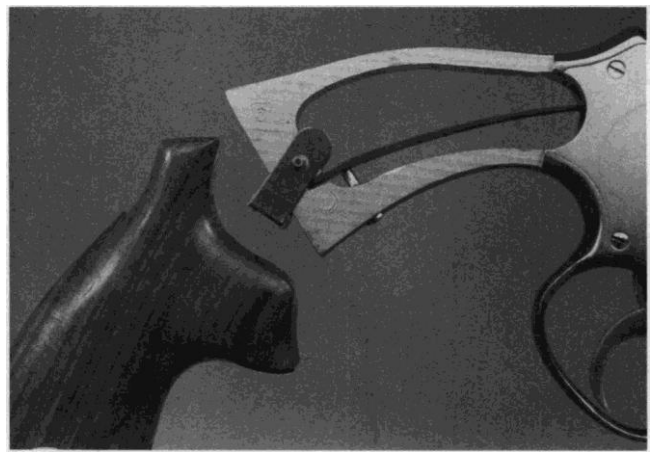
Traditionally, grips have been two pieces, one on either side of the frame. Guy Hogue designed his one-piece Monogrip, wood or rubber, to slide up over the frame from the bottom.



Hogue Monogrips are one-piece grips of wood or rubber.



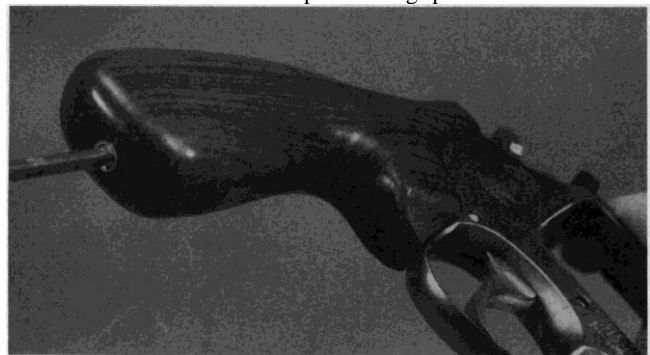
Here is the slot that the grip stirrup must follow to the bottom.



Slide the stirrup onto the grip slot.



Slide the grip up the frame until it stops.



Monogrips use a single screw on the bottom.

Hogue Monogrips are much easier to fit than you might think. Remove your present grips. On Smith & Wesson revolvers there is a locating pin in the bottom of the grip strap which keeps the wood grips from shifting. Your Monogrip attachment will go over this pin, but don't try to spread the attachment to fit. Instead slide the attachment over the frame from an angle. Once one side of the attachment has snapped over the locating pin, slide the attachment vertical to the frame to snap it over the other side of the pin. On revolvers that do not have the pin, Hogue provides one to fit over the bottom strap of the revolver.

Grips must not have sharp edges in the wrong spots. While sharp checkering can be an asset (once your hands become accustomed to the points), sharp edges never are. Hold the handgun in your firing grip. Look closely at the top of the grip near your thumb. Are the edges there sharp? Do they rub against your thumb? Look at the other side, where your trigger finger curls around to the trigger. Is the edge there sharp? Does it touch your finger? All these sharp edges have to be dulled, or knocked down.

While you are checking for edges of the grips that will interfere with your hands, check for function of the other parts of the pistol. Does the safety hit the grip? Extended thumb safeties on the 1911 can stop on the left grip before they have travelled their full downward distance. Ambidextrous safeties can do the same on the right-hand grip panel.

On double-action pistols, or pistols with a de-cocking lever, check the function of the safety or de-cocker. Does it travel smoothly, and snap back cleanly? Also check the magazine catch and slide stop.

To remove the sharp edges, use your Swiss pillar file. Once you have the sharp edges removed and the grips clearing the safety and other levers, use some 400-grit cloth with the file as a backer, and polish the edges smooth. If the de-cocking lever on a DA pistol is not functioning smoothly, use the cloth backed with a file to polish the surface of the wood the lever slides against. When it is smooth, switch to 600 cloth. If the grips are wood, seal with Grip Dip or other wood finish. Micarta, plastic, pearl, ivory or ivory polymer grips do not need a sealer. Rubber grips probably don't need the edges filed.

Many grips have a joint between the two halves. If the two sides don't line up perfectly, the gap or ledge can be very uncomfortable. Pachmayr solved this problem by molding the grips as one piece that you flex to fit on the frame. With other grips, check the joint of the two halves all the way around. File and sand the edges to remove any ledges. Grips that are much too large can be filed, see above.

Revolver grips either cover the backstrap, or fit flush. Mis-fitting flush grips can only be fitted if the grips are too high. File them as above. If the grips do not come up to the surface of the frame, you can blend them only by filing the frame. Don't. Instead, send the grips back to the manufacturer with a note about your problem. They can send another set that are up to the frame.

Fitting the "rubber band" grip adapter

All the grip makers who make rubber grips offer a slide-on grip enhancer. Some of these have finger grooves molded into them. Others are just a rubber sleeve. Both add a rubber non-slip surface to the molded polymer frame of Glocks, the S&W, Sigma, Ruger P-95 and other pistols. They can even be slid onto pistols that already use grips, but sliding them over rubber instead of plastic grips is like gilding the lily.

The question on the minds of many shooters who buy slide-on grip enhancers is "How do I install this without destroying it or going crazy?" If you just grab the pistol and the sleeve and try to wrestle them together, you can tear the sleeve. Worse, you can hurt yourself. There is an easier way.

Clamp the pistol upside down, by its slide, in a padded vise. Take the sleeve, and heat it. Use a blow dryer if available, or a pan of hot water if not. The blow dryer is preferred because you can re-heat the sleeve after it is partway onto the pistol. When you go to slide the sleeve on, work alternating sides down the grip a little bit at a time. If you try to slide too far too fast, you will tear the grip. Don't go more than a quarter of an inch at a time. Don't try to grasp a lot of the sleeve when pulling it on. You will stretch the rubber too much and tear it.

You do not want to use anything under the grip to help it slide. No talcum powder, no vaseline, no lubricating oil. Once the grip is on, you want it to stay. Lubricants that help you slide the grip on will allow the grip to shift after you are done.

Slide the grip up the frame (down towards the vise), checking the fit, until you get to a point where it feels comfortable. I find that a comfortable spot on the Glock frame ends up with the sleeve so high it interferes with the magazine catch. If this is true for you, too, don't worry. A sharp knife or razor blade cuts away the sleeve to clear the magazine catch.

Chapter 15 - Timing and Tuning Your Revolver



It used to be called “Trigger Slick” and now it is Trigger Job. This tiny jar is a decades’ supply, even used with a heavy hand. Buy it. Use it. It will make you happy.

Your hands provide all of the operating power in a revolver. In a single-action, your thumb and trigger finger do the work. In a double-action, your trigger finger has to “shoulder” the entire load. It’s a lot to ask, when you consider how rarely fingers come equipped with shoulders.

The chief culprit making this work so hard (aside from basic anatomy) is friction. The relatively rough surfaces of the working parts and the slots in which they travel work against you in both directions. The friction of the surfaces moving past each other and binding against toolmarks, which until now you may have barely noticed, not only make it tough for your finger to work the action, they also require greater spring tension to move parts.

Remove this friction, and you will improve your action. Here is an overview of the process.

In all revolvers, the main friction points are (1) the cylinder rotating on the centerpin or crane, (2) the hand advancing the cylinder, and (3) the hammer and trigger pivoting on their pins, double-action revolvers have to re-set the mechanism, a task handled by the rebound block. It also adds friction. For all the revolvers covered, there are reduced power spring kits available; however, you must reduce friction before you can reduce the spring tension. If you reduce the spring tension on your revolver first, the roughness only becomes more apparent.

When you stone parts to remove tool marks and roughness, remember that you must not change the angle of any surface. Rounding off corners never improves an action, and in many cases if you go too far you will end up buying new parts to replace those you have been stoning.

The crowning touch to any action job is lubrication. In addition to a synthetic lubricant to protect against oxidation and to keep powder and dirt from hardening on the parts, use a low-drag lubricant such as Chip McCormick’s Trigger Job or Brownells Action Magic II on the bearing surfaces. The CMC Trigger Job in particular is very persistent. Once on your parts, it stays, and even cleaning solvents will not entirely remove it. Both these low-drag lubricants can leave your parts so slippery you may not be able to pick them up easily when reinstalling them. They are available in handy form, the CMC Trigger Job in a syringe, the Brownells in a pair of squeeze bottles.

Single-Action

The basic mechanism of the single-action revolver dates back to 1836. Samuel Colt’s revolvers used percussion caps to set off their gunpowder. The caps were not very sensitive, and the black powder then in use needed a large, vigorous flame to set it off consistently. Colt designed the hammer to be heavy enough to do the job reliably, and the mainspring to be strong enough to power that hammer. A thick mainspring had another important advantage. It was easier to make without flaws, and thus more likely to work all of the time on the far frontier, where the handgun was going to be used.

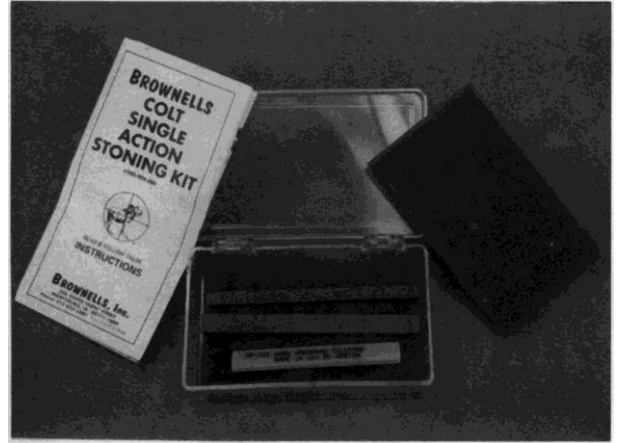
Before you jump in and ease that unnecessarily heavy spring tension, though, consider the underlying friction. The friction is the problem. The heavy mainspring is just a symptom. First reduce the friction, then address your mainspring.

Pull out your Brownells catalog, and find the specialized stones for work on the SAA. The slots that you will be polishing are narrow, and regular stones will not fit. These stones are ground specifically for the job of polishing out the Colt, Colt clones and Ruger SA revolvers.

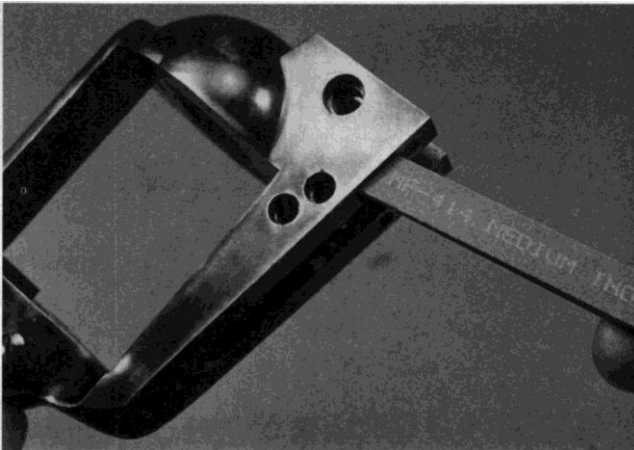
Disassemble and degrease the revolver. Start with the medium stone, and polish the slots in which the hammer and hand travel. You do not want to remove every trace of toolmarks with this stone, because if you do you will widen the slot, and the hammer and hand will wobble. Once you have polished the surfaces enough to show half the area brightened and polished, switch to the fine stone. Polish the slots until the high spots show a near-mirror gleam.



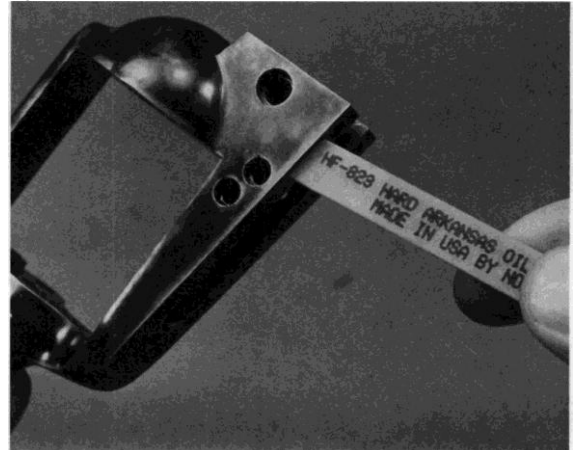
It takes some special stones to do a proper job on the single-action revolver.



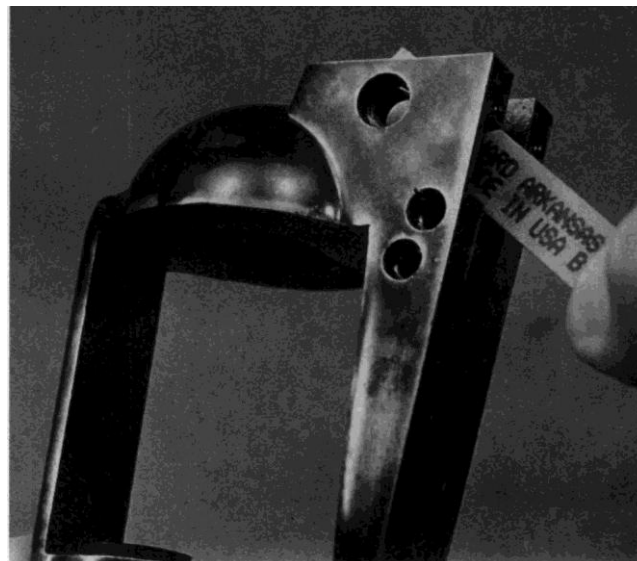
Brownells makes a set of stones specifically for smoothing the action of your single-action revolver.



Use the tapered stone to polish the insides of the hand slot. First the medium stone....



then the fine stone.



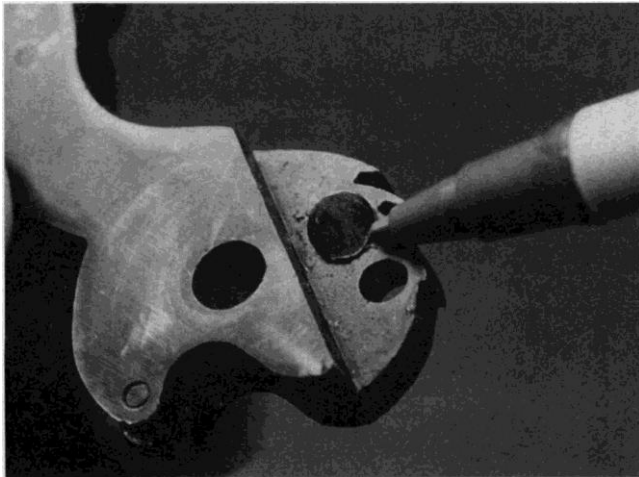
Use the medium and then the fine stone on the sides of the frame where the hammer pivots.

Move on to the hammer and hand. With the medium stone polish the flats of the hammer just enough to show the high spots. Then switch to the fine stone and again, polish to a near-mirror surface. The stone is not fine enough to bring a true mirror finish to the surface.

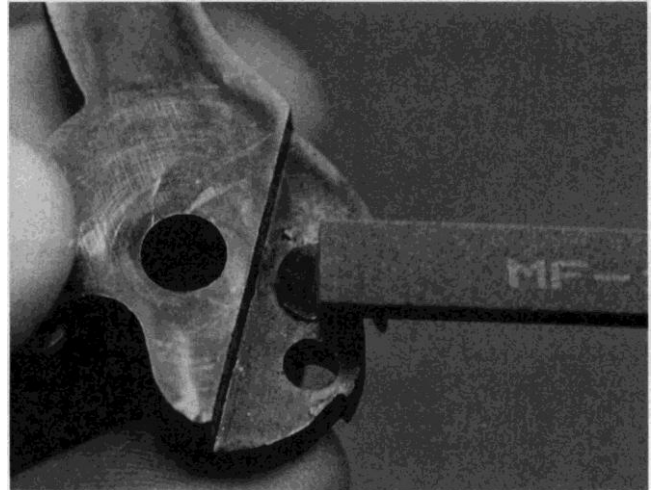
If you want more polish on the hammer and in the slots, you have to get a finer polishing tool. Take a hardwood stick that will fit in the slots, and file one end rounded. Take a strip of cloth, an old bed sheet will work, and loop it over the stick so your hands keep the cloth in place. Dab the end with 600 grit lapping compound, or 1200 grit polishing rouge. Use the stick to polish the slots to a mirror finish. Do the same to the hammer flats.

There is an inset cylinder, or boss, on the hammer, on the portion cut away from the pivot end. The boss, which works the cylinder bolt, has its end cut on an angle. As the hammer is cocked, the boss draws the cylinder bolt down, then releases it to lock the cylinder at full cock. When the revolver is fired, the angled side flexes the cylinder bolt leg out of the way, and then comes to a stop under the cylinder bolt leg, ready to draw the cylinder bolt away from the cylinder the next time it is cocked.

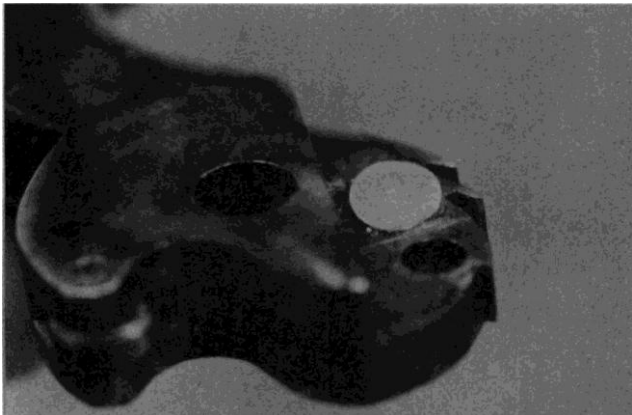
Polish the beveled face of the boss to a mirror finish, but do not round the top edge of it. Rounding this edge may prevent the cylinder bolt from being drawn down, and the cylinder will not rotate.



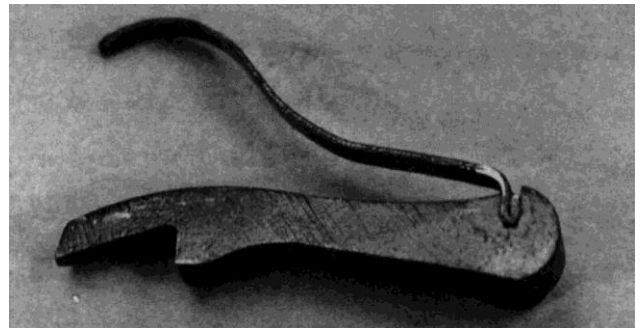
The hammer boss on the Colt hammer. Commonly rough, stoning helps to smooth the action.



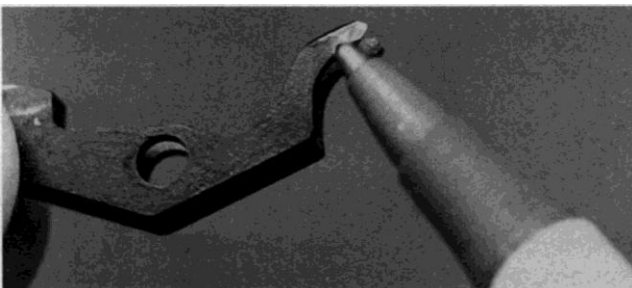
Stone the face of the boss.



Once it is polished, break the rough edges off the top curve of the boss.



The hand spring is delicate. Other than lightly stoning the sides of the hand, leave this alone.



The left arm of the cylinder locking bolt rides on the hammer boss. Stone the outside, and the top bevel of the arm.



The polished arm doesn't look much different, but works much smoother.

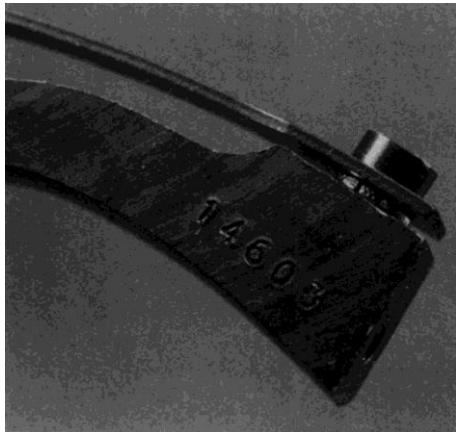
For the hand, polish the three sides that face away from the hammer. Use the medium stone, then the fine stone, and finish with 600 or 1200 grit cloth backed by a flat surface. Do not polish the tip, or the spring. Hand length is critical to correct timing of the cylinder. If you shorten the hand through stoning or polishing, you can cause the timing to come up short, and prevent carry-up.

On the cylinder bolt, use a small round stone, or a strip of 600 cloth backed by a round file, to polish the inside curve of the cylinder bolt leg. Polish the cam edge of the leg, where the boss flexes the leg aside on firing.

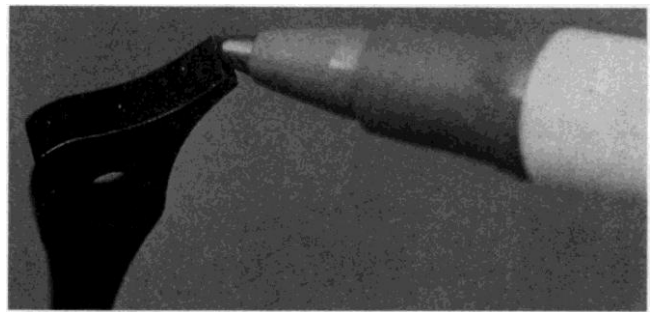
The centerpin is your last part to polish. If you have a lathe or drill press you can polish with power. Otherwise, clamp the centerpin in a padded vise and use 600 or finer cloth to polish the centerpin in a shoe-shine manner. You are not trying to polish the entire surface to a mirror finish, just the high spots. If you are overly vigorous, you will reduce the diameter of the centerpin, and the cylinder will wobble. Even the smallest amount will be enough to hurt accuracy.

So far, you have not touched the sear engagement. You may not have to. The polishing you have already done to reduce friction can reduce the feel of the trigger pull by a pound. If you still find the trigger pull is too heavy, though, try switching your mainspring for a reduced power mainspring. For the Colt and Colt clones, use a reduced mainspring from EMF. For the Ruger single actions, use a Wolff reduced power spring set. I find that using the reduced mainspring, with the factory trigger springs, leaves the Ruger trigger pull light enough to use, but safe enough to handle.

On the Colt, or Colt clones, a trick to try before stoning the sear is to put a leather, plastic or rubber washer between the frame and the base of the mainspring. Tightening the mainspring screw clamps the washer in place. Do not use more than 1/8-inch thickness. The washer changes the angle of the mainspring, and eases the cocking force.



To ease hammer tension on your single-action revolver, place a small washer between the frame and mainspring.



The tip of the hammer is the sear. Do not stone this without a fixture. Any change in the angle can alter the trigger pull greatly.

Another trick to try before stoning the sear is to use Chip McCormick's Trigger Job, or Brownells Action Magic II on the sear engagement. Quite often, a penny's worth of these super-slick lubricants can save you quite a bit of money on stoning fixtures.

If all these tricks and stratagems don't reduce your trigger pull to a comfortable level then the only thing left to do is stone the hammer and sear. You must have a fixture. If in an attempt to save money you go without one, you will most likely end up not only buying the fixture, but also a new hammer and trigger to replace the ones you stoned without the fixture.

Use the fixture to stone the engagement surfaces to a mirror finish, and ensure that the surfaces are at the correct angle. Do not file or stone the top of the hammer notch, or attempt in any way to make it shallower. Properly polished, the trigger pull will feel fine with the standard depth notch. If you make it shallower, you increase the chances that the notch will chip, or the trigger tip will break, rendering the revolver unsafe.

Once stoned, clean out the grit, lubricate and reassemble the hammer and sear.

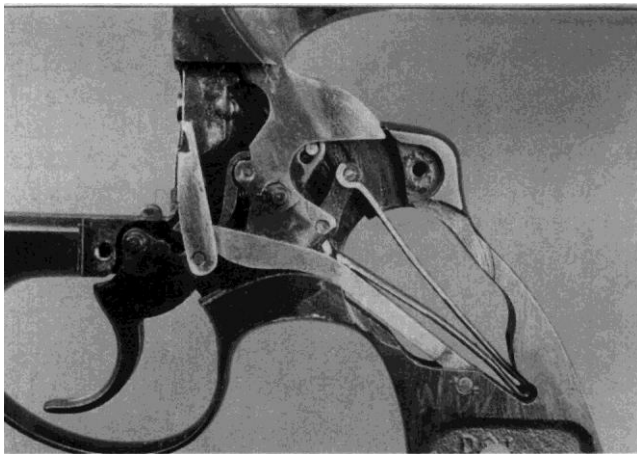


The author is happy with this slicked-up EMF Hartford revolver.

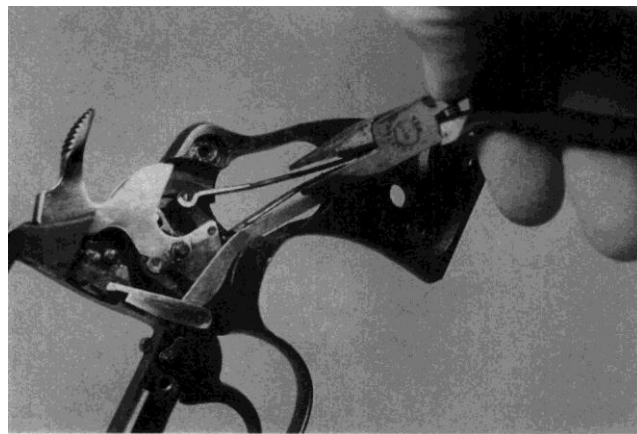
Ruger single-action

Ruger single-action revolvers follow the same pattern as the Colt, with the fragile leaf springs replaced with coil springs. Polish the same places you did in the Colt section. One additional place to polish are the corners of the hammer strut. This is a stamped part, and you can feel the sharp edges riding in the inside of the mainspring.

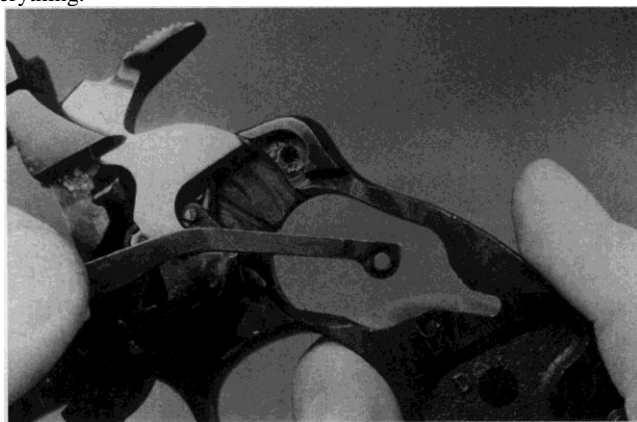
Wolff offers a reduced power spring kit for the Ruger. You should polish the action first, and then install the reduced power spring only if the trigger pull is still too heavy.



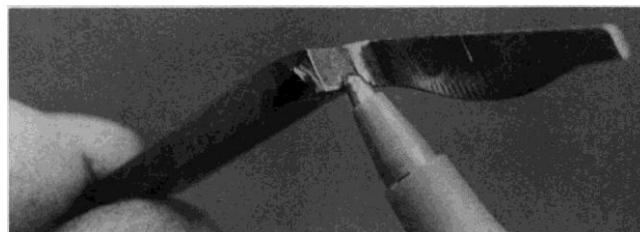
The Colt "V" spring action. The large bar on the bottom controls everything.



To disassemble, compress the mainspring with pliers and lift it out.



Drift out the action bar pivot pin and remove the action bar.



This is the hammer rebound shoulder. It cams the hammer back from the primer, and prevents the firing pin from reaching the primer until the trigger is pulled.

Double-action revolvers—Colt V spring

The Colt V spring action originated at the beginning of the 20th century, when steel was expensive and labor was cheap. The design, a marvel of complexity, requires years of practice and study to fully understand. Few and far between are the gunsmiths qualified to work on it. The common models you will run into are the Python and the Detective Special.

You can slick up the action on your own, but serious problems must be referred to a professional.

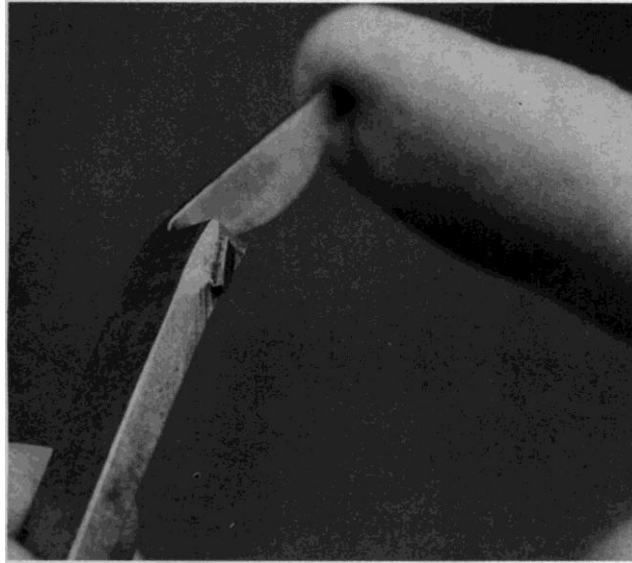
Disassemble the revolver, and remove all of the internal parts except the cylinder bolt, which you will leave in place. On the trigger, stone the top of the double-action sear. Do not stone the tip in an attempt to lighten the single-action trigger pull. Stone the three sides of the hand that are facing away from the trigger, but—again—do not stone the tip. Hand length is always critical to correct timing. As with Colt SA revolvers, stoning the tip can shorten the hand, and prevent carry-up.

Use a short, small-diameter punch to drift the pin of the double-action sear out of the hammer. Use a round stone to polish the lower front of the hammer's DA sear. The trigger rubs against this area during trigger return. Stone the inside of the DA sear, where the trigger bears against it during the double-action stroke. At the minimum, both of these areas must be polished to a 600 grit surface.

When you reassemble the DA sear to the hammer, be sure the pin is secure in the hammer, and that it is flush with the hammer. If you have to stake the pin to keep it in the hammer, stone down any high spots left by the staking.

Stone the safety bars enough to polish the high spots, but no more.

On the rebound bar, stone the underside of the forward tip, where it bears against the hand. Very carefully stone the shoulder that bears against the hammer. This shoulder cams the hammer back from the primer, and allows the safety bar to slip between the hammer and frame.



The small diamond on the right side controls the cylinder locking bolt. Do not do more than polish this diamond.

The most delicate stoning of all is the triangle found on the rebound bar. Do not use anything coarser than an extra fine stone on this triangle, and use a delicate touch. How delicate? Take a stack of new copying paper, and jog it so all the edges are flush. Pick only the top sheet off the stack, without disturbing the flush edges. That delicate.

The cylinder does not easily come off of the crane on these Colt revolvers. Rather than investing in a wrench and staking tool, slide the crane out of the cylinder without disassembling them. Clean and degrease the bearing surfaces, and treat with Brownells Action Magic II. Slide the crane back into the cylinder. Use compressed air blown at an angle into the chambers to spin the cylinder, burnishing the bearing surfaces. Repeat the Action Magic and spinning.

The traditional method of easing spring tension on these Colts, of sticking a rod in the spring and cocking the revolver, was necessary before the advent of reduced-power mainsprings. If you want a lighter spring buy a reduced power mainspring from Wolff. If you want to try the old method, buy extra springs to experiment on and keep your original one unmodified.

Modern Colt double-action revolvers

Because of the need for years of training to properly assemble and tune the V spring revolvers, Colt designed a different mechanism. Gone is the rebound bar, and its excruciatingly difficult to fit and time triangle. The improved mechanism is found in the Mark III, King Cobra and Anaconda revolvers.

After you disassemble and degrease the parts, start with the trigger. The front end of the trigger has a tip that looks like the beak of a small bird. It pulls down and then releases the cylinder bolt, letting the cylinder rotate. Stone the underside of this beak, but do not shorten the tip. On the back end of the trigger, stone only the top of the double-action sear. The rear of this end of the trigger is the single-action sear. Stoning the single-action sear must be done with a fixture, if, and only if, your single-action trigger pull is too heavy. One revolver in several hundred leaves the factory with a single-action trigger pull that is too heavy, and that does not improve with dry-firing.

On the hand, stone the sides, but not the tip. Do not try to polish the hand pin. Instead, use McCormick Trigger Job on reassembly.

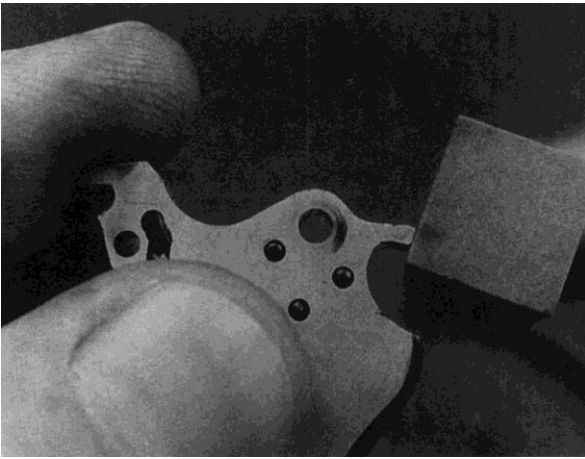
On the hammer, slide the double-action sear out of the hammer, and hang on to the spring and plunger that are behind it. Stone the underside of the DA sear, where the trigger picks up the hammer on the start of the DA stroke. Stone the top face of the DA sear, where the trigger rubs on its return stroke.

Polish the mainspring strut.

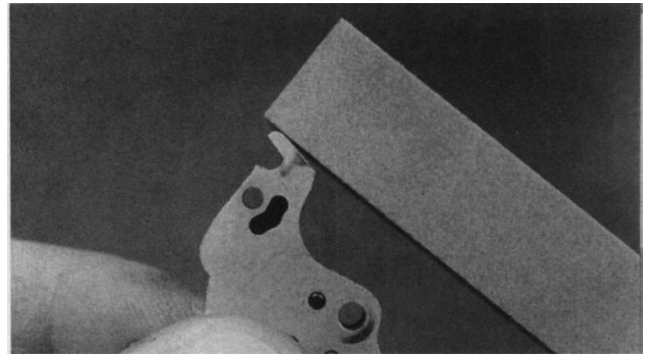
Unlike the Colt V mainspring revolvers, the cylinder comes off the crane easily. The ejector rod threads into the extractor star, and is secured at the factory with a mild grade of Loctite. Clamp the ejector rod in a padded vise or one with lead or copper jaw protectors, and turn the cylinder to unscrew. Polish the crane, and when you reassemble use McCormick Trigger Job or Brownells Action Magic II on the bearing surfaces. When you screw the rod back in, use Loctite #290 and tighten lightly.

S&W double-action revolvers

Detail strip and degrease the revolver. Start with the trigger, and use a fine or extra fine stone. On the front of the trigger, stone the bottom of the tip, where it bears against the cylinder bolt. Stone from side to side. Do not round the corner. On the rear of the trigger, polish the top, and the curve of the double-action sear. Move the stone from the center towards the rear of the trigger, following the curve of the double-action sear. Do not follow the curve all the way to the end. That end, or tip, is the single-action sear. I have never seen a Smith & Wesson revolver straight from the factory that needed improvement in the single-action trigger pull.



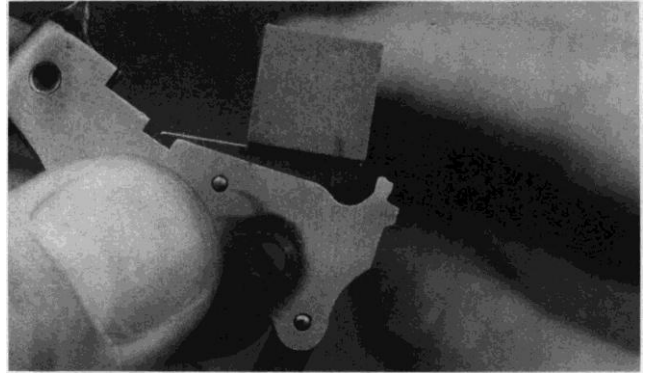
Stone the front face of the trigger.



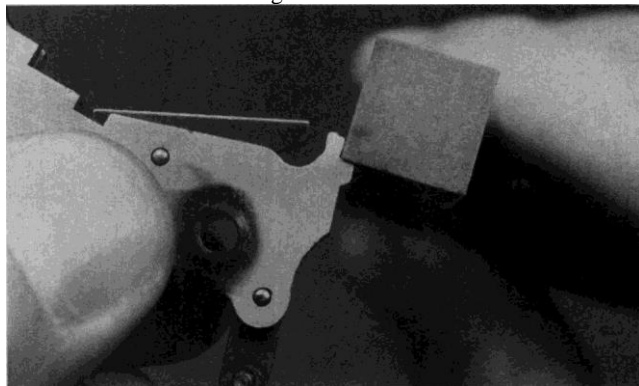
Stone the curve of the trigger, starting here with each stroke, and....



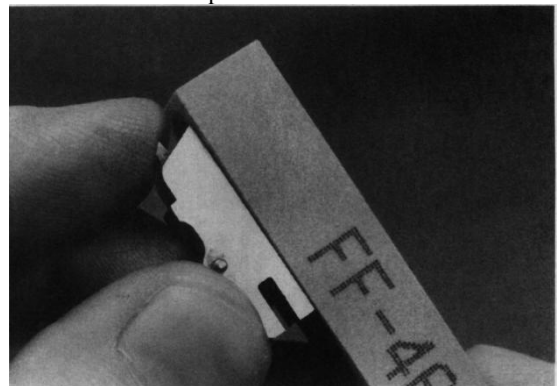
following the curve to here.



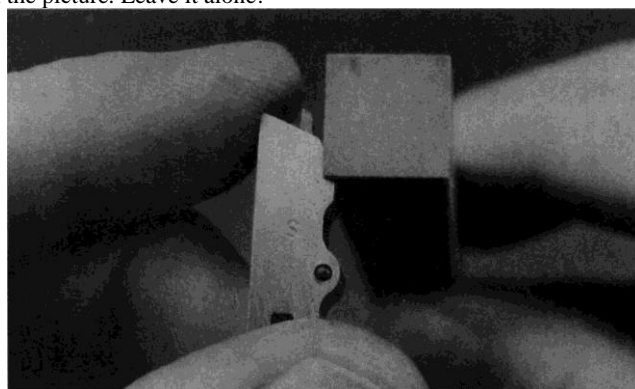
Stone the top of the double-action sear.



Stone the underside of the hammer. The single-action notch is that tiny little thing just to the left of the stone in the picture. Leave it alone!



Stone all four sides of the rebound block.



Stone the front face of the rebound block.

With these two trigger areas polished, go to the cylinder bolt. Stone the angled face of the bolt bright. The trigger pushes against this surface when it resets after firing.

On the hammer, polish the front end of the double-action sear. On reset, the trigger must push the sear out of the way, and by polishing here you will smooth the feel of the trigger re-set. On the bottom of the hammer, stone the safety foot. The safety foot is cammed back by the rebound bar, forcing the firing pin away from the primer and keeping it there.

The biggest part of your action job will be working on the rebound bar. Unlike the other parts, the rebound bar does not pivot. It slides. Use a fine or extra fine stone to polish the sides of the rebound bar until they are mirror-bright. Use a round file or steel rod wrapped in 600 grit cloth to polish the inside of the bar, where the spring resides. Polish the cam lump on the top of the bar, which engages the safety foot of the hammer.

For the cylinder to move as smoothly as possible, the crane must be aligned and any endshake removed. First, alignment. Put the crane alignment gauge in the crane, and close the crane. See if the alignment gauge slides smoothly and freely into the centerpin hole in the frame. If it does not, use a nylon wedge or crane bar to bend the crane in the correct direction. The wedge can only correct up and down. The bar can correct in all four directions. Do not try to make your correction all at once. Tweak and check, tweak and check.

Once the gauge moves smoothly in and out, remove endshake (see Chapter 6).

With endshake removed, polish the bearing surface on which the cylinder rotates. Clean out the grit from stoning. Burnish these surfaces after polishing, using compressed air to spin the cylinder. Once it is spinning as fast as the air will drive it, remove the air and let the cylinder come to a stop on its own.

Reassemble using a synthetic lubricant. For extra smoothness apply Chip McCormick's Trigger Job or Brownell's Action Magic II. Both these lubricants are somewhat resistant to solvents, so you won't have to reapply them after each cleaning.

If you feel that you need a lighter double-action trigger pull, you can use a Wolff spring kit, or a Powers mainspring, to ease the spring tension. Before you go making the springs too light, let me remind you that Jerry Miculek uses the factory springs as Smith & Wesson ships them—unless he needs a heavier spring. Remember, lighter springs can make the action sluggish enough in double-action shooting that the trigger cannot keep up with your trigger finger.

Ruger double-action revolvers

Disassemble the revolver, and detail strip the trigger assembly. Carefully capture the springs and plungers from the hand, safety bar and cylinder bolt. They should be set aside or marked, so you can put each spring and plunger back correctly in its starting place.

Stone the safety bar on the front and back. The hand (or pawl, as Ruger calls it) should be stoned on all four sides, but not on the tip. Stone the sides of the trigger. The top rear of the trigger, where it bears against the double-action sear of the hammer, should be stoned. Do not stone the rear face of the trigger, or single-action surface. You must use a fixture to stone this face, and only if your single-action trigger pull needs it. Few do.

On the hammer, stone the bottom of the double-action sear, and its front face where the trigger bears against it on trigger return. The hammer flats need to be polished. Start with a fine or extra fine stone. You want to polish the high spots, but you must not reduce the hammer thickness. Stone only the bottom, pivot section of the hammer. Stone the slots in the frame where the hammer rotates.

Stone the top of the hammer strut, where it bears against the hammer. Stone the sides of the strut, and slightly round its corners. The hammer strut is a stamped part, and the edges can be rough. Rounding the corners smoothes the spring's travel over the strut.

Unscrew the ejector rod from the cylinder. Note that Ruger uses left hand threads. Clamp the ejector rod in a padded vise or in lead or copper vise jaws, and unscrew the cylinder counterclockwise. With the crane stripped, stone the bearing surfaces, treat with Action Magic II and spin the cylinder with compressed air.

When reassembling the trigger housing, do not be bashful with the McCormick Trigger Job. Use it, or Brownells Action Magic II on the hammer, safety bar and hammer strut.

Chapter 16 - Basic Pistolsmithing The Glock



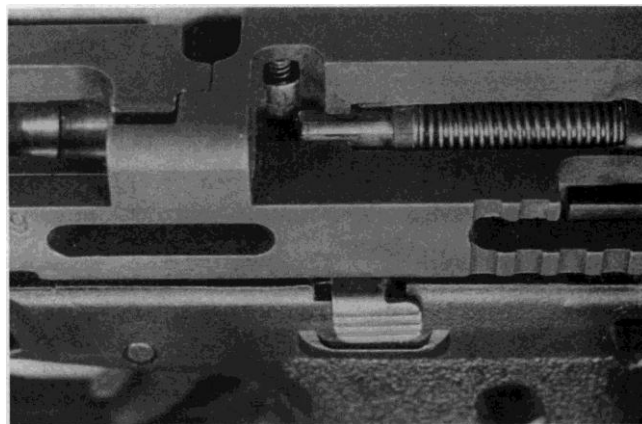
Big or small, all Glocks work the same way.



The trigger safety. If your finger does not press the center bar, its rear will not clear the frame.



Underneath the ejection port is the locking block. The angles of the barrel cam the barrel up and down to lock and unlock it. Right behind the feed ramp of the barrel is the part of the trigger bar that pushes the firing pin safety out of the way as you pull the trigger.



Here you can see the firing pin safety, just above the striker (firing pin). If the trigger has not been pulled, it will not move out of the path of the firing pin.



This Glock cutaway has been used to soothe distraught customers who had been told untrue things about the Glock. It allows you to see all the workings of the Glock, without being able to actually fire a round.

In response to a proposed pistol contract for the Austrian Army in the early 1980's Gaston Glock designed the Glock Model 17. Although his company had manufactured items for the army before, he had never designed a handgun.

Rather than re-hash old ideas, Glock started with a clean sheet of paper. The result was a revolution in handgun design, with an impressive list of firsts and unique features: (1) a polymer frame (2) no external safeties (3) three internal safeties (4) a surface finish on the steel harder than anything available from any factory (5) amazing durability and reliability, and (6) a new benchmark for stark, utilitarian looks.

The Glock Model 17 was quickly adopted by police departments across the country and the world. Once that happened many civilian shooters had to have one, too.

The very things that make the Glock unique and attractive—such as its easily installed replacement parts—also make it difficult to modify or pistolsmith. The areas that you can readily change are sights, barrel, slide stop and magazine release, trigger pull, and recoil springs.

Sights

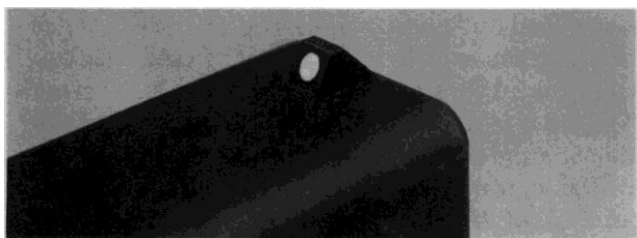
Glock sights are plastic. Unfortunately plastic, while inexpensive to manufacture, does not stand up well to hard use. With only a few weeks of draw and dry-fire practice your front sight can be visibly worn. The Glock rear is a plastic casting with a small steel plate at the bottom to engage the corners of the dovetail. If you drift the sight out you must be careful to put your punch at the bottom of the dovetail against this plate. If you don't you will damage the rear sight removing it. Glock adjustable rear sights are well-known for their frailty.

The original front sight uses a small wedge to hold it in place. If you want to replace this plastic sight with a steel one, you will find your replacement comes with a small screw that threads into the bottom of the sight. Be sure to use Loctite to secure the sight and screw. Replacement rear sights slide into the rear dovetail, just like the originals.

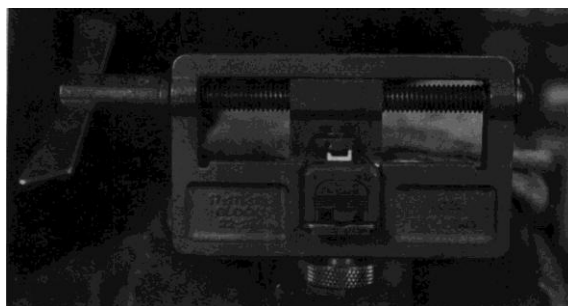
The most durable replacement rear sights, available as plain, three-dot and night sights, are from Novak and MMC. With any of them you can keep your original front sight.

If you want to replace your original rear sight with an adjustable one, the Mec-Gar or Pachmayr sights use the original front sight, or a replacement of the same height.

The Millett adjustable rear sight slides into the dovetail, but requires a front sight much taller than the factory original. Millett makes a screw-on front sight that uses the standard Glock oval. If the screw-on front sight comes off, (it's a big piece of metal, after all) buy a new Millett Dual-Crimp front sight and install it.



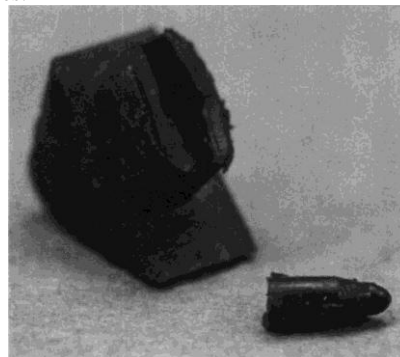
The standard Glock front is a small plastic pyramid. It can wear enough to change your point of impact. Change it to a steel sight for greater durability.



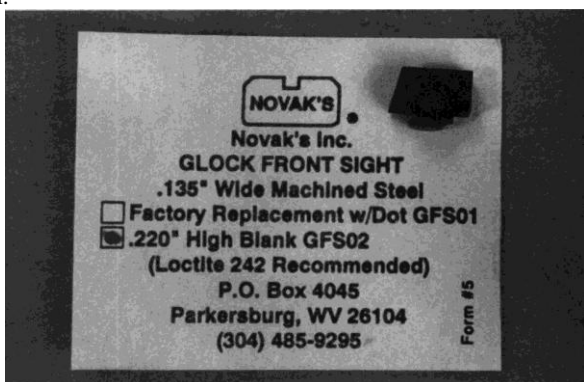
Glock makes a sight pusher to handle their sights. The angled sides of the rear sight, and its plastic composition make using other sight pushers difficult at times.



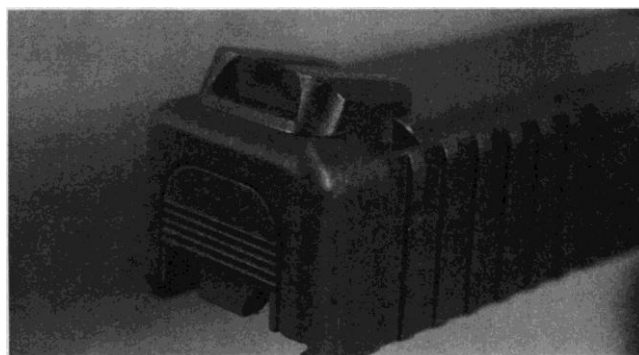
The standard Glock sight is plastic, and not as durable as the rest of the pistol.



The Glock front sight and its wedge.



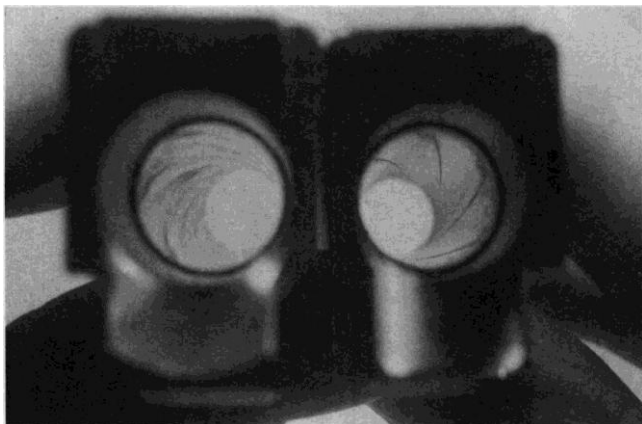
This Novak front sight is taller than standard so it can be filed down to a perfect height after test-firing.



The Novak sight is a very durable all-steel unit that fits the standard Glock dovetail.

Barrels

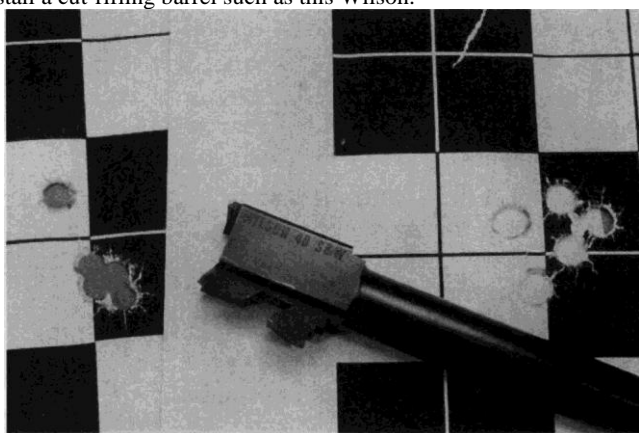
The Glock barrel does not use regular-style rifling. Traditional rifling is cut or swaged into the barrel's bore as a square-bottomed channel. In swaging, a super-hard button that is shaped in the intended rifling pattern is pushed through the barrel. Whether cut or swaged, in cross section the raised portion, or "lands," and the lowered portions, "grooves," look like a gear.



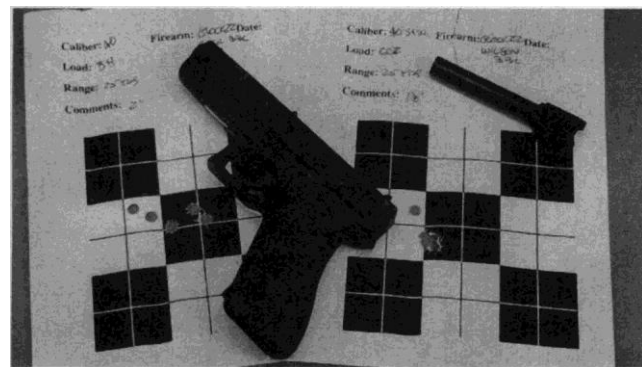
A cut-rifling barrel for the Glock on the right, and the Glock barrel on the left. If you want to use lead bullets in your Glock you will have to install a cut-rifling barrel such as this Wilson.



The authors dependable assistant, Mike Clare, helping with the chronograph work.



The Wilson barrel and two groups, each just over an inch across. Groups this size are not rare with a match barrel in the Glock.



The standard Glock barrel is accurate. The Wilson barrel is even more accurate, and handles lead bullets too. The flier on the right-hand target is probably due to the shooter.

The rifling on a Glock barrel is curved. Instead of right-angled lands and grooves, the Glock lands are gently rounded above the grooves, in theory minimizing wear. As a traditional bore wears, the top corners of the lands become eroded, allowing gas to leak past the bullet. Called "blow-by" these leaks may harm accuracy. In a Match barrel, however, the steel is so hard that any erosion of the lands is so slow as to be nonexistent. I have cut-rifled pistol barrels with close to 100,000 rounds through them that are still delivering match accuracy and show no signs of blow-by.

Although Glock barrels may not wear any better than any other top of the line Match barrels, the rifling allows Glock to manufacture the barrels cheaply. The rifling on a Glock is also very easy to clean— with one big exception. Glock barrels hate lead.

The use of lead bullets in a Glock barrel will cause severe leading and loss of accuracy. As each bullet tries to push its way through the lead deposits left by previous ones, chamber pressure soars. In the .40, the leading can push pressures past the physical margins of brass and steel. Several Glock .40 pistols have been blown up by their owners—just by using lead bullets.

Intended as a pistol for use by law enforcement agencies and the military, neither of which use lead bullets, Glock rifling was designed only for use with jacketed bullets. What to do? Your first choice is not to use lead bullets in a Glock barrel. Buy jacketed ammunition, or jacketed bullets if you are reloading. Your second choice is not to use your Glock barrel. Replace it with one that has cut-rifling in the bore, allowing the use of lead bullets. Many barrels are available, from the "A" of Accu-match to the not-quite "Z" of Wilson (and including just about everyone else in between).

For those who want to stick with their Glock barrels, the question arises—is a Glock barrel accurate? Yes. With my Glock Model 22 in .40 S&W, I tested factory and reloaded ammunition using jacketed bullets. Accuracy was more than adequate for the pistol's intended use.

For those who want to stick with lead, there's another question—how cost-effective is swapping barrels? To figure this out, I compared the cost of lead bullets per thousand to jacketed bullets per thousand. Using the least-expensive replacement barrel available, you would recover your investment in 3,000 rounds. The most expensive barrel would be paid for in 5,000 rounds. A serious competitor could recover the cost of a cut-rifled barrel in a few months. Less serious shooters could still recover it in a year.

Fitting a new barrel

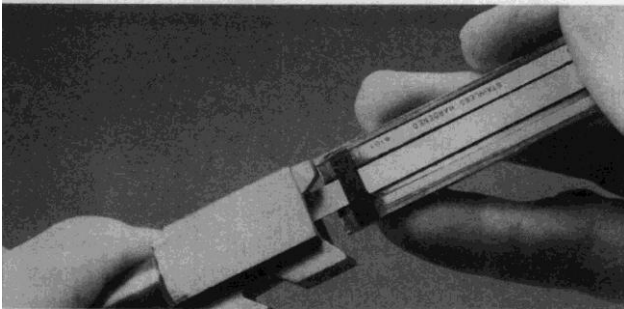
Disassemble your Glock and remove the factory barrel. The new barrel should slide into place. If it doesn't, take a close look and see where it is binding.

If the barrel binds on the sides of the hood, file them to provide at least .003-inches of clearance.

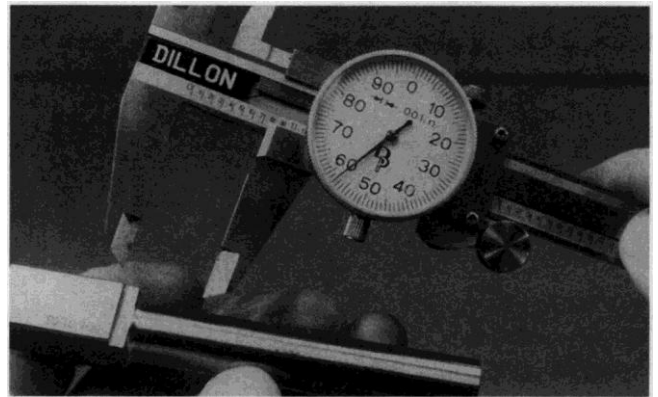
If the barrel binds on the rear of the hood, apply Dykem and try to force the barrel into place. File where the Dykem has been rubbed off, and try again. Once you can force the barrel into place, switch to a medium fine stone and stone the end of the hood until the barrel moves smoothly into place in the slide.

Measure the chamber length. If the chamber is now shorter than the caliber minimum, you must lengthen the chamber with a chambering reamer.

I did not need to file the Wilson barrel I tested and went right to the stoning. Many Glock replacement barrels are intended to be drop-in units. The Wilson chamber was the correct length and did not need reaming.



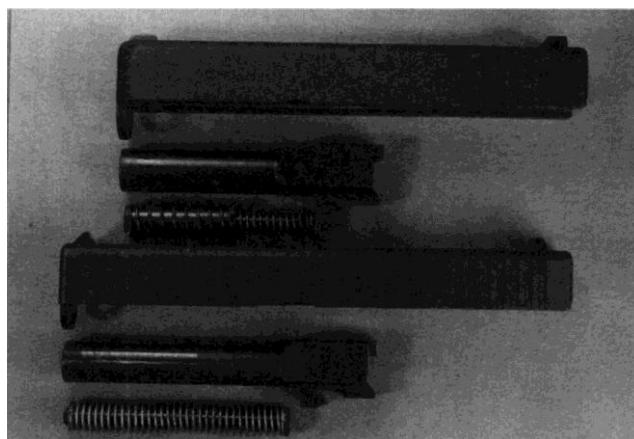
Once your new barrel is fitted to the slide, measure the chamber length. It should not be less than the caliber minimum length. If it is, ream it carefully until it is just at the minimum.



This 9mm chamber measures .757-inches, just over minimum and has proven itself to be ultra-reliable.

Caliber changes in the Glock

It is possible to change the caliber of your Glock. You can either change the barrel, or change both the slide and barrel.

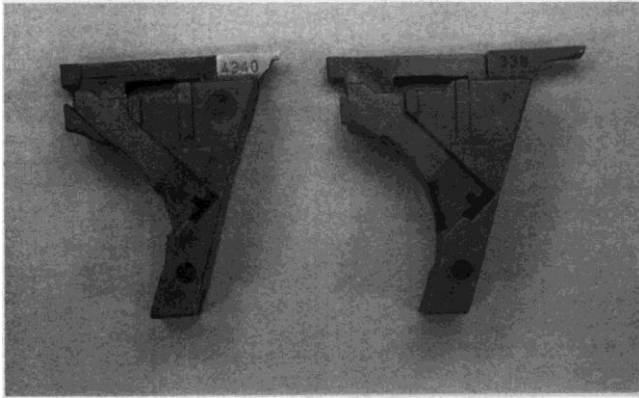


While it looks like the only difference between these two Glocks are the lengths of the slide and barrel, that is not the case. Some models have minor differences to preclude installing a shorter (or longer) slide and barrel on a particular frame.

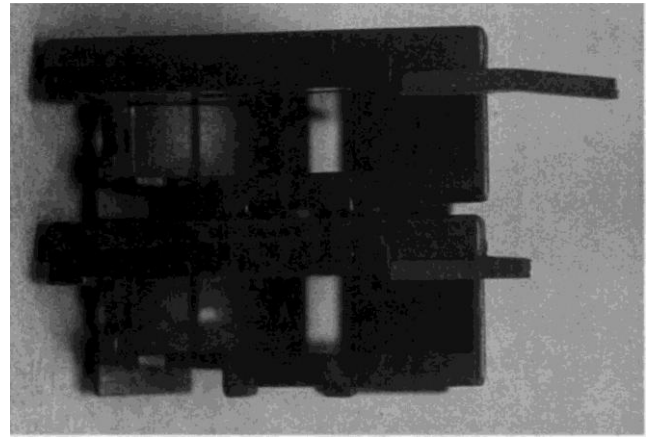
Calibers that share a head size can be interchanged with the change of a barrel. For example, Glocks chambered in .40 can also shoot .357 Sig. Since the .357 Sig cartridge is basically a necked-down .40 S&W case, by installing a .357 Sig caliber barrel you can shoot either caliber. The same process works for a Glock in .45 ACP, re-barreling it to .400 Cor-bon. Use the original slide, and fit the new barrel.

To change calibers where the case head size is not the same you will need an extra slide. You can get slides from Glock or Caspian Arms. Since you must use the same length slide that the pistol had when it left the factory you can't build a short-barreled pistol on a standard frame—as you can with a 1911.

Soon after I bought a Glock Model 22 in .40 S&W, I lucked onto a source of cheap and readily-available 9mm. Sometimes the ammo was jacketed, and sometimes it was loaded with lead bullets. I obtained a slide in 9mm from Caspian arms, and fitted it with an Olympic cut-rifling barrel.



Not only are these Glock ejectors shaped differently, but they have different part numbers.

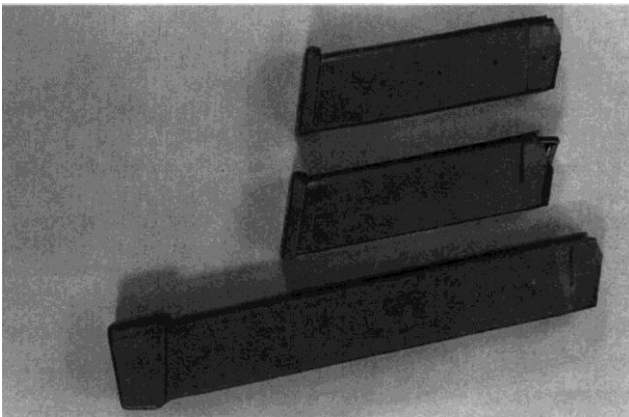


When switching from a .40 S&W upper assembly to a 9mm upper assembly, you will have to change connector housings. The 9mm ejector is longer, and bends slightly in towards the center. You cannot use a 9mm ejector with a 40 slide and barrel, or vice versa.

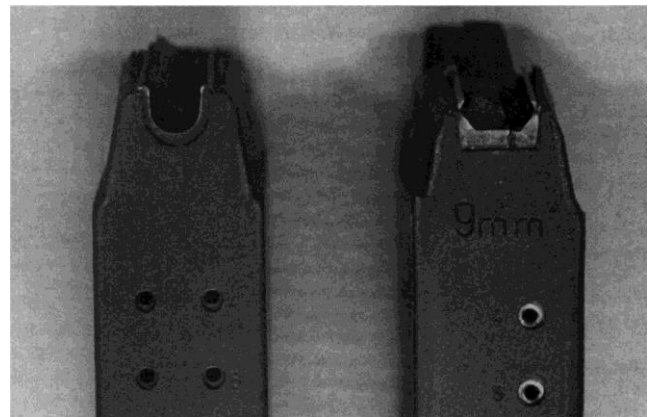
Fitting the barrel to the slide took a little time (it wasn't a drop-in barrel), but was easy. Because the hood was longer and wider than the slide opening, I filed and then stoned the hood until the barrel moved smoothly into place. The chamber was short, so I reamed it to the minimum dimension. Through test-firing I learned that the slide would not always fully close; the minimum chamber size was too small for reloaded ammunition. I reamed the chamber .002-inches longer. Once I did that, by switching slide assemblies, ejectors and magazines I could shoot either 9mm or 40. I had a two-caliber handgun.

Slide stop and magazine catch

The Glock was designed as a combat pistol, long on toughness and durability, short on the touches that make it fast in a match. The slide stop is small and hard to use, and the magazine catch is sometimes so stiff you need both hands just to release it.



Glock magazines come in a variety of capacities. On the top, a full-size high-cap magazine, 15 rounds of 40 S&W. In the center, a full-size magazine that holds 10 rounds. On the bottom is a 29-round magazine. While the high-caps are legal, they are also hard to find.



The old Glock magazines would not drop-free from the pistol. They have round notches on the spine. The newer ones drop free, and they have square notches on their spine.

When the Glock first came out, the magazines wouldn't drop out of the pistol. After you pressed the magazine "release," you then had to wrestle the magazine out of the frame. Apparently it is not the custom in Europe to let expended magazines fall free to speed the process of reloading. When American consumers complained about needing three hands for a reload, Glock made changes. If you want a magazine that falls free, look for one with a square notch on the back. The old magazines have a U shaped notch on the back. Both feed just fine.

It is easy to find and install a larger slide stop. They are available from both Aro-Tek and Alchemy Arms. Remove the locking block pin as described in Chapter 5 and pull the old slide stop out. Slide the new one in, replace the locking block pin, and you are done.

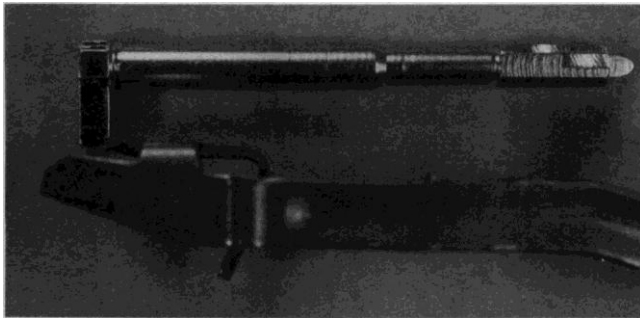
The easiest way to get a larger magazine catch is to go with one from the next larger frame Glock. The only difference between the magazine catch for the 9mm/-40 pistols and that of the 10mm/-45 pistols is the length. Install a 10mm/-45 mag catch on your 9mm/-40, and you have an over-sized button. If you want to do the same for your 10mm/-45 you have to get a button from Alchemy Arms or Aro-Tek.

Changing the magazine catch can be a frustrating experience. Take the slide assembly off of the frame, and clamp the frame in a padded vise. The mag catch is held in by a wire. You will have to reach into the magazine well with a screwdriver and pry the wire out of its seat in the magazine catch. It will snap clear. Pull the old catch out, slide the new one in and use the screwdriver to flex the spring back into its seat in the new magazine catch. It's dark in there. You don't have much leverage. Use good lighting, a long screwdriver, and plenty of patience. The last time I changed a magazine catch the wire slipped off of the screwdriver seven times before I had it free. After that, the three attempts to secure the wire almost seemed easy. Patience is essential.

Trigger pull

The Glock does not respond to the usual trigger-pull enhancement techniques. Because you would be pushing a polished stainless steel plate over plastic, stoning won't help. The engagement of the trigger bar to the striker tail has no bearing on trigger pull. The two things that will improve your trigger pull are changing the angle in the connector and replacing the spring in the connector body.

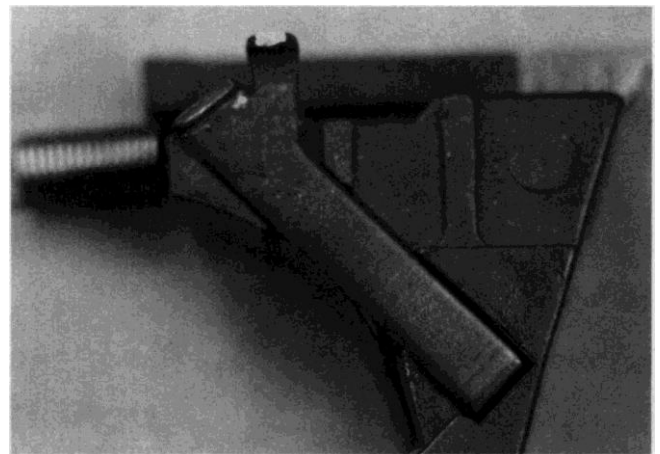
As the trigger bar moves back under your finger pressure, it cocks the striker. At the end of its stroke, the connector pushes the trigger bar away from the striker. The shallower the connector angle, the lower the apparent trigger pull. To change the angle you must change the connector. The standard connector is a so-called 5-pound connector, the target connector is a "3.5-pound" connector.



Here is the relationship between the striker and the trigger bar. The trigger bar pushes the striker back until the curves part of the trigger bar is cammed down by the connector angle. Then the striker is released, hitting the firing pin.



The trigger bar, from the front where it contacts the firing pin safety, to the rear where it contacts the connector.



Here is the installed 3.5-pound connector. The small tab attached to it is the disconnecter. The slide presses this tab towards the centerline, allowing the trigger bar to slip off the connector, re-setting the mechanism.



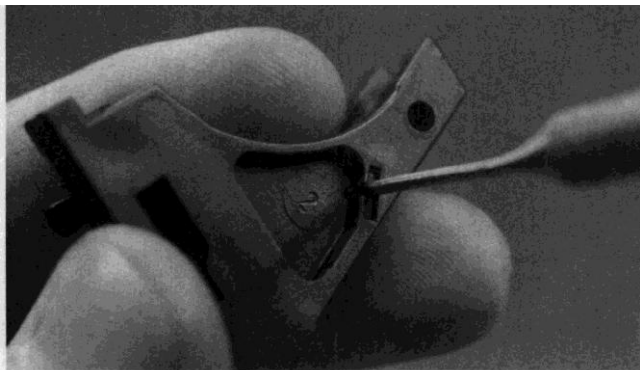
The difference between the connectors is the angle of the camming shoulder. On the right, an 8-pound, in the center a 5-pound, and on the left a 3.5-pound.

If you want a new connector for your non long-slide pistol, send for one from Alchemy Arms or Aro-Tek. Disassemble the pistol and strip the trigger mechanism from the frame. On the trigger block, push the tail of the connector out from the other side, and then pry it free. Push the new connector into place. Use a dab of McCormick Trigger Job on the angle of the new connector. If the connector came with a new spring, and you are improving your trigger for competition, un-loop the old spring and loop the new one on in the same direction. Reassemble and check function. Test fire and see if you like the results.

If you want a factory connector for your long-slide pistol, you must send it back to Glock. They offer it on the 17L and 24L long-slide match pistols. Glock will not sell you a 3-5 pound connector to install yourself.

For competition, improve the trigger pull of your Glock by replacing the factory striker with one made of titanium. Titanium is lighter than steel, and the striker will get to the primer faster once it is released. This shorter lock time improves your shooting.

If you carry your Glock for personal defense you may want to increase your trigger pull. The Glock's standard trigger pull, their "5-pound" connector, is similar to the feel of a double-action pistol in the single action mode. In the first half, when you are taking the slack from the parts, the trigger has a light pull. As you draw back the striker the pull gets noticeably heavier.



Use a small punch to press the end of the connector, from the ejector side of the housing.



With the connector pushed up, you can grasp it to pull it out of the housing.



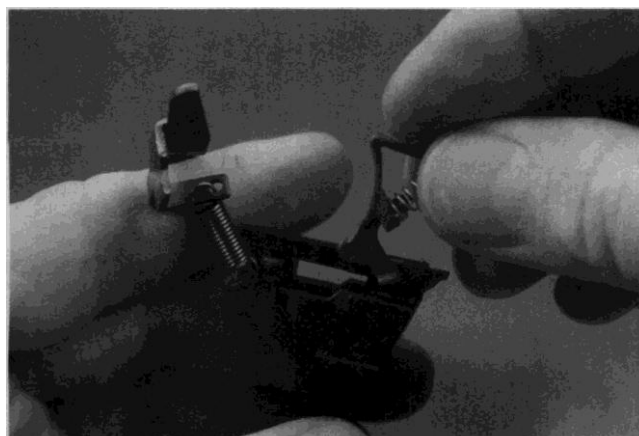
After removing the old connector, press the new one into the connector housing.



Unhook the trigger bar from the connector housing and swing it out of the way.



The rear of the trigger bar spring is hooked onto the connector housing. You have to remove this spring when installing a New York trigger spring.



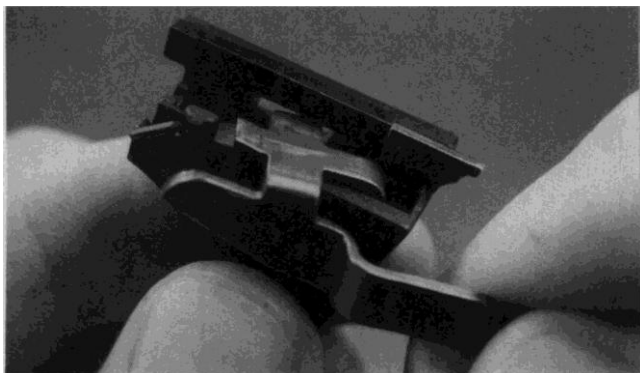
Press the spring into the connector housing.



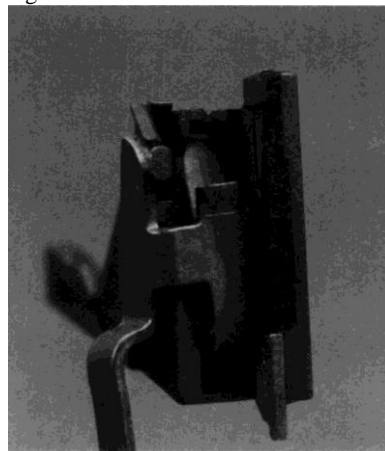
Here the New York Trigger spring is in place.



When the little foot on the bottom of the New York Trigger spring snaps in place, the spring is installed.



Use the trigger bar to compress the top of the New York Trigger spring and install the trigger bar in the connector housing.



Here you see the New York trigger spring installed, and the standard coil spring removed.

When police departments started turning in their revolvers for Glocks they wanted a trigger pull that felt more like a revolver double-action—the same weight all the way back. Glock's first attempt at a uniform trigger pull was to offer an "8-pound" connector. While it made the second part of the pull heavier, the heavier connector did not change the initial light pull. Many police departments, including New York City, still found the pull unsatisfactory. It was just too light at the start. For them Glock designed the "New York Trigger." The "New York Trigger" is simply a replacement spring that makes the trigger pull feel the same for its entire distance.

Police officers spend much more time pointing handguns at suspects than they do firing them. While holding a group of suspects at gunpoint the hazard of a light trigger can be significant. A loud noise, a quick movement, an officer who stumbles—any one of these can lead to a suspect's being shot. Rather than spend millions on lawsuits, New York City spent pennies on a new trigger spring.

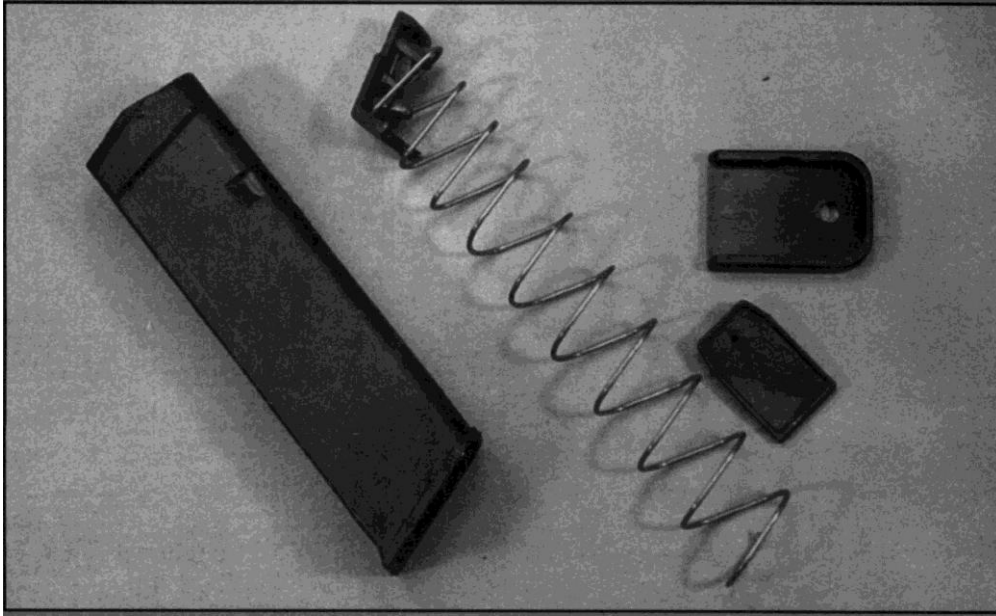
The New York trigger is a prudent choice for anyone who carries a Glock for defense. Under the stress of a violent encounter, its extra weight and feel can keep you from a ruinous accident.

The New York trigger spring is intended only for use with a 5-pound connector. Don't install both an 8-pound connector and a New York Trigger spring in your Glock. The combination generally results in a pistol that will not fire.

Recoil springs and guide rods

Originally, Glock designed their plastic guide rod with a separate recoil spring. Later they changed this to a guide rod with a captured spring. Now when you pull the rod and spring out the captured spring will not launch itself across the room.

To change the balance of the pistol and dampen recoil, you can install a steel or even tungsten guide rod. The spring will no longer be captured, but for many shooters that is a small price to pay to reduce the felt recoil of hot hollow-point ammunition. You can even replace the standard guide rod with a dual spring guide rod from Sprinco. It will take the snap out of the recoil of hot ammo like Cor-bon.



Glock magazine tubes are steel-lined, but encased in polymer. The follower, baseplate and baseplate retainer are plastic. If you want your magazine catch to last, use polymer magazines with polymer mag catches. If your magazines are steel, switch the mag catch to steel.

The Glock magazine catch, frame, and magazine body are polymer.

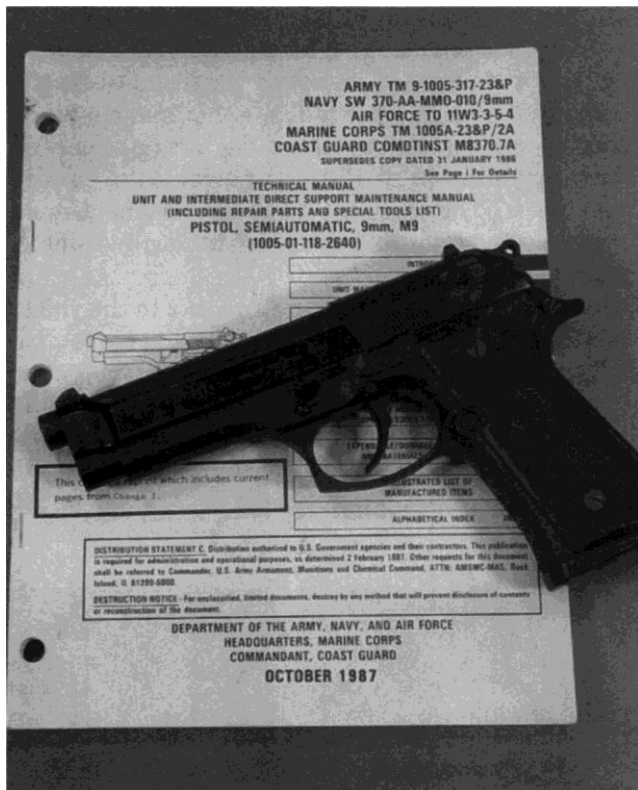
The frame has a steel skeleton in its upper part. Parts of this skeleton stick out of the polymer to form the slide rails.

The magazines have a steel sleeve inside them, to stiffen the magazine tube. The old, non drop-free magazines had steel on only three sides, and the magazine was supposed to swell slightly to keep it from dropping out when released. The drop-free magazines have steel in all four sides.

Unlike the rest of the pistol, the magazine catch does not have any steel in it. If you use a steel-bodied replacement magazine, you will ruin your magazine catch. In a choice between steel and polymer magazines for a Glock, always take the polymer. For all other pistols, always take the steel.

If you already have steel magazines for your Glock invest in a steel magazine catch from M. G. S. so the magazines don't chew your polymer catch to pieces.

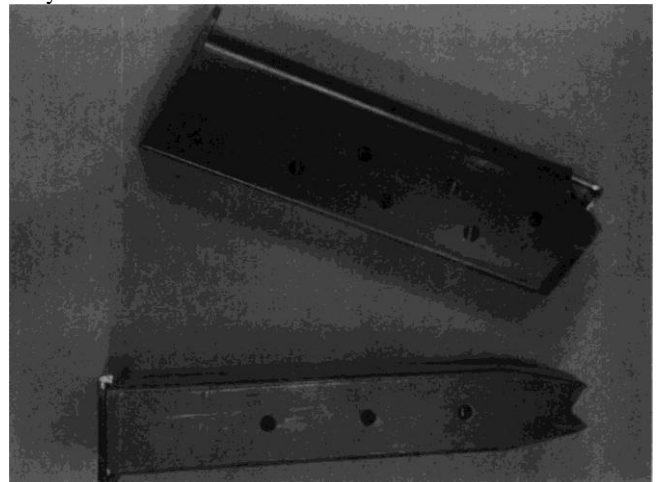
Chapter 17 - Basic Pistolsmithing The Beretta



When the government adopts any new piece of equipment, they require training and service manuals. The Beretta manual covers all disassembly. Buy the book, but don't buy government-marked parts.



The old and the new. The Beretta has more safety features, more rounds and is double-action. The .45 has worked for almost all of the 20th century.



One reason to change military pistols: The .45 magazine holds seven, while the 9mm holds 15.

When the Service Pistol Trials of the 1980's were announced, purists and traditionalists were outraged. Drop the 1911?! How could anyone in his right mind want to drop the 1911? It had always performed admirably, producing a record of performance, durability and dependability that nothing else in the government inventories—firearms or otherwise—had approached!

And to change from the powerful .45 ACP to a wimpy 9mm? Heresy!

Even a quick look at the list of desired features of the new pistol, however, not to mention the reasons for those features, made one thing painfully obvious. The old—that is, the 1911—was on its way out, and the new would be adopted. The only question was: Which one?

The winner of the trials and the subsequent government contracts was the Beretta M-92, or as it is known in government parlance, the M-9. It is a big, double-action pistol with a hammer-dropping safety mounted on the slide.

In combat, the Beretta's 15 round capacity offered an extra measure of reassurance. The double-action trigger pull and hammer-dropping safety meant fewer accidents. The change to 9mm meant lower costs for ammunition and less recoil for the troops.

Having been adopted as the “pistol for all,” the Beretta M-92 soon found itself being castigated as suitable for none.

Early on there were some problems with slide durability; the government issued ammunition was grossly over-pressure. The ammunition was changed. Beretta also made changes, modifying the slide so if it did break completely in two the broken piece would not come flying off the back of the pistol.

Because of the broken slides some shooters complained that the Beretta M-92 lacked reliability. Others, noting its aluminum frame, started questioning its durability. And still others claimed it wasn't accurate enough.

All the Berettas I have ever shot functioned reliably. The few I have seen broken had seen so much use they were worn silver from handling, and no one could even guess as to how many rounds they had fired.

What do shooters use the Beretta for? Service Teams must use the Beretta in bull's eye competition. All service competitions now require Berettas—after all, it is the service pistol. Outside the armed forces, competitors in the new International Defense Pistol Association use the Beretta, favoring its light recoil, high capacity and good accuracy. There are even shooters who use it for bowling pins, for the same reasons.

If you're thinking “Aw, come on!” as you read this, you're probably comparing a rack-grade issue Beretta to the hand-built 1911's formerly used by the armed service pistol teams. That's an unfair test. The Beretta is not built to be a target pistol. You have to make it one.

But before we begin customizing, a moment to warn you against buying parts for your Beretta with government stock numbers on them. Except for magazines, no parts manufactured for the government have been released for civilian use. This means that if the parts you are looking at have a National Stock Number on them, they have been stolen. Remember this when buying parts!

Sights

To customize your Beretta, look first to the sights. The Beretta's front sight is a permanent part of the slide. If you want to make it different, you have two choices. Paint it or send it off to have it drilled. That's it. For night sights you must send the slide off to Trijicon's installation address (Tool Tech Gunsight Co., 20 Church St., Oxford, MI. 48371).

The Beretta rear sight rests in a dovetail in the slide, and can be readily changed. Mec-Gar makes adjustable rear sights you can fit to your dovetail, and Aristocrat makes a fixed sight. Both use the standard front sight.

Millett makes an adjustable rear sight that slides into the dovetail. It requires a replacement front sight which, after you have drilled the original sight, slips right on. Use a drill press, with the new sight base as a guide. Install the cross pin to keep the new sight in place.

Improving accuracy

You have three choices for improving accuracy in the Beretta. You can reduce the play of the barrel in the front of the slide. You can replace the barrel with a more accurate one. You can even do both.

The Beretta barrel does not ride snugly in the end of the slide. The pistol is designed so the back end of the barrel rides in rails cut in the frame. The front does not need to fit snugly to operate and be accurate enough for military issue. For competition, though, reducing this play will increase accuracy significantly. Jack Weigand makes a nose-piece that attaches to the end of the slide and reduces the play. The nose-piece comes with instructions. If you don't want to fit it yourself, just send the pistol to Jack.

There are a number of firms that make replacement barrels for the Beretta, though not as many as there are for the 1911. Fitting a barrel to the Beretta is not hard. You can get a large improvement in accuracy without needing to do any fitting by using a Bar-Sto drop-in barrel.

Unlike the 1911, the Beretta locks to the slide with a pivoting block on the bottom of the barrel. Before you install a new barrel, see how the factory barrel fits. With the slide off the frame and the recoil spring out, check the fit to the breech face. Look at the movement of the locking block into its recesses in the slide. Your new barrel should fit this well or better.



The Beretta M-92 above and the M-8000 below.

Take the barrel out of the slide and drift the retaining pin out of the bottom rear lug of your old barrel. Pull out the activator pin. Slide the locking block out of the old barrel. You will need these parts for the new barrel.

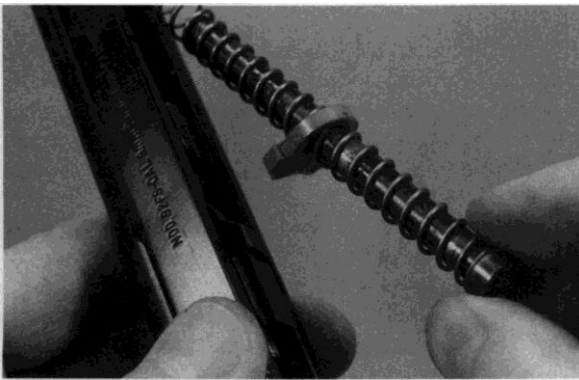
Once you have your pistol apart, take your old barrel and slide it into its riding grooves in the frame. It should slide freely all the way back. Your new barrel should also slide this freely.



On top, the Beretta M-92 with its tilting locking block. Below, the Beretta 8000 with the rotating barrel and its camming block.



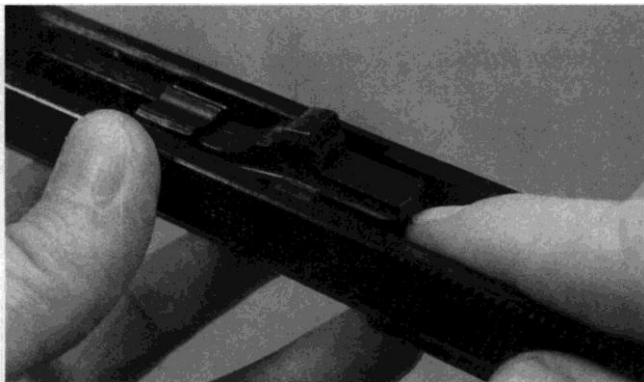
Press the guide rod slightly forward to remove it from the barrel seat.



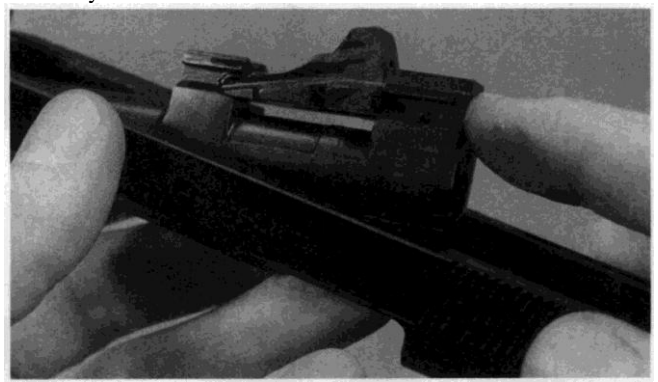
Lift the recoil spring guide rod up and out to the rear.



The cam pin unlocks the barrel during recoil, and allows for disassembly.



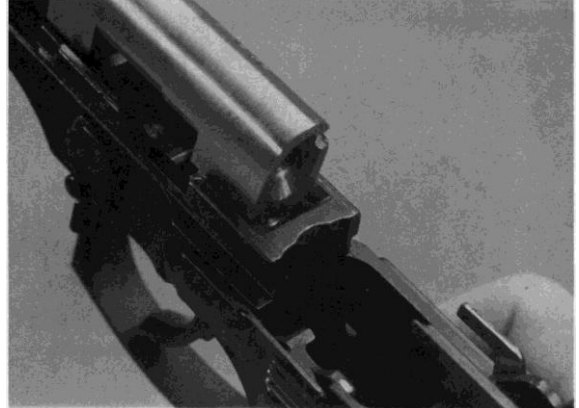
Push the cam pin to unlock the barrel from the slide.



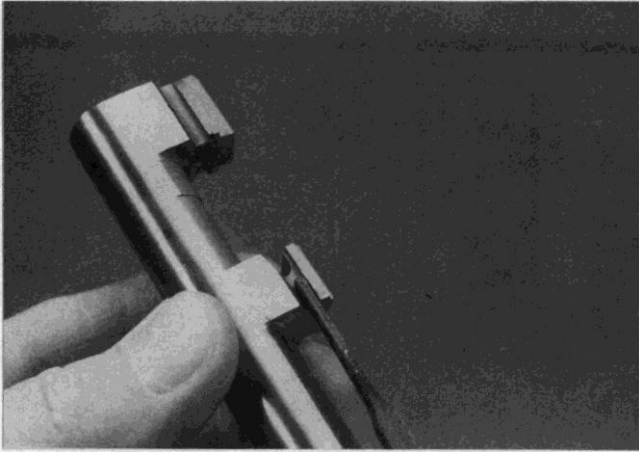
Press the rear of the barrel out, and lift the barrel to the rear to remove it.



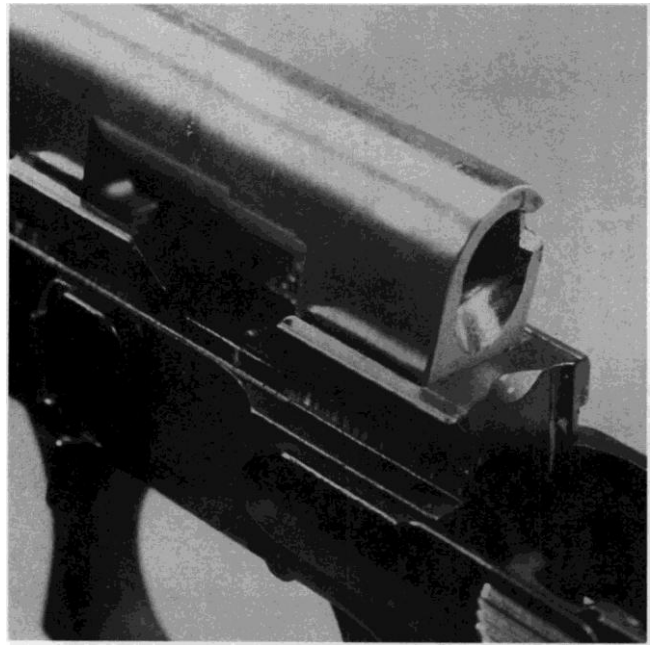
Slide the barrel into the frame slots.



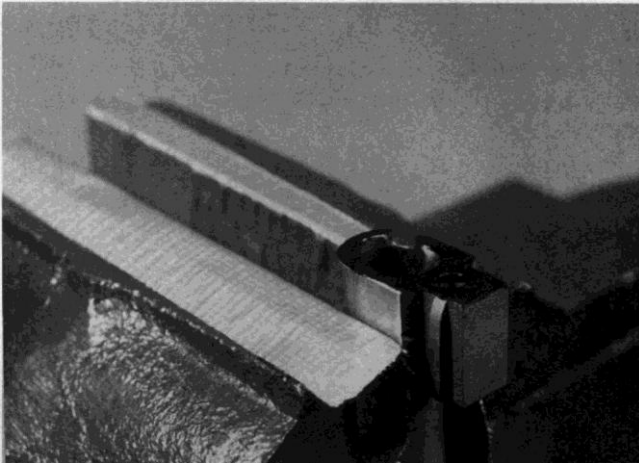
Check the barrel in the frame. If it will not freely slide all the way to the rear of the slots, you must file or stone it.



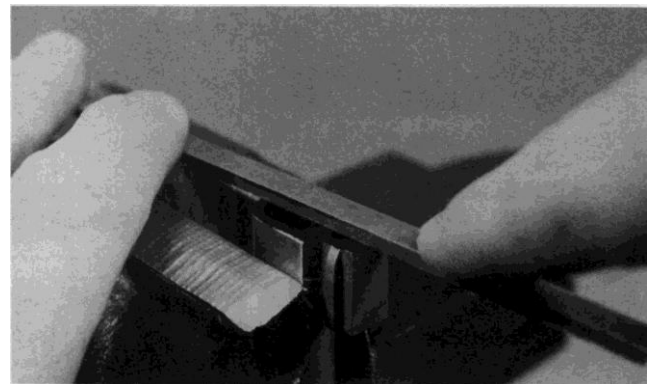
Use a narrow stone or modified file to dress down the high spots. Work slowly. Don't remove too much.



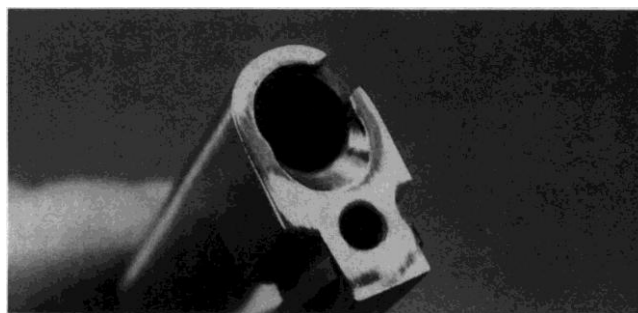
Once the high spots have been filed or stoned, the barrel will freely slide all the way back into the frame.



If your barrel does not lock up, mark the back of the barrel and place it in a padded vice.



Then file if with a few strokes.



Just a little filing, then re-check. Repeat as necessary.

Now take the new barrel and check its fit to the frame. If it does not slide freely, apply Dykem to the bottom rails to see where the barrel is binding. You will need a narrow file or stone. Stone the rails until the barrel slides smoothly all the way back into the frame.

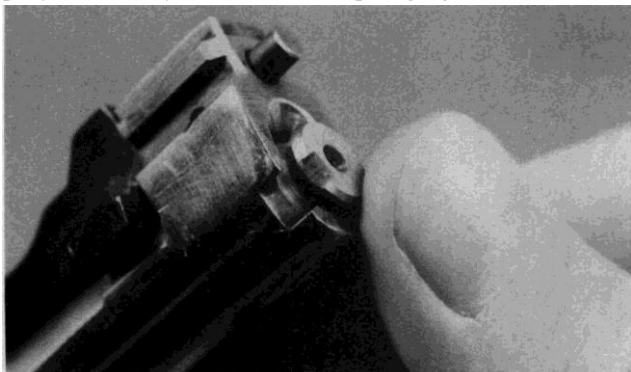
Install the locking block and cam pin, and insert the barrel without the recoil spring into the slide. Try to press the locking block to its closed and locked position in the slide. If the block is sticky or will not close, the barrel must be filed on its rear face. Remove the locking block and cam pin, apply Dykem to the rear face of the barrel, and file until the Dykem is gone. This should only take a few strokes. Check the fit again. Repeat until the locking block moves smoothly into the slide.



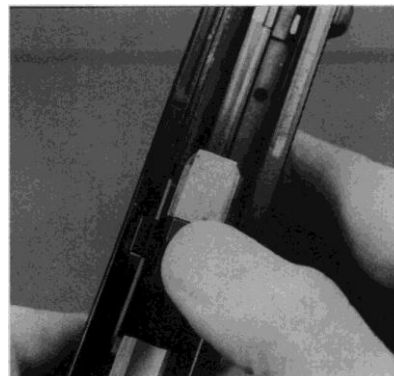
It is not possible to directly measure chamber length on the Beretta. To properly fit a barrel you will need headspace gauges.



Line up the extractor cut in the gauge with the extractor slot on the chamber.

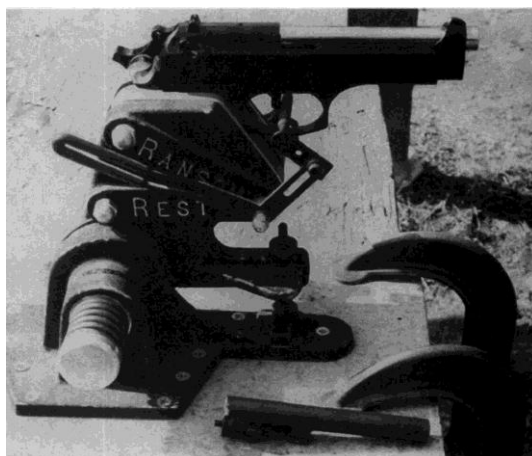


With the headspace gauge installed, check the barrel in the slide by....



Trying to press the locking block into the slide. When it slides into place without pressure, you are done.

With a set of headspace gauges from Clymer check headspace. The “go” gauge is precision ground to the proper minimum chamber size, while the “no-go” gauge is made just larger than the largest safe size the chamber can be. Start with the “go” gauge. Place it in the chamber with the extractor cut lined up with the extractor. Place the barrel in the slide. The locking block should lock into the slide with a “go” gauge in place, and fail to close with a “no-go” gauge in place. If the locking block will not close with a “go” gauge, your chamber is under the minimum size. Get a chambering reamer. Apply cutting oil to the reamer, place it in the chamber and turn it only one turn. Swab the oil out of the chamber and test with the “go” gauge again. If necessary, repeat, but only if necessary. Reaming your chamber even a little too large is hard on your brass. It also degrades accuracy. Go even farther and you will ruin the barrel. When the chamber will accept the “go” gauge, try the “no-go” gauge. The slide should not close, unless you reamed too much.



The Olympic match barrel getting tested in the Ransom rest.

Test fire. Keep track of what ammunition you use. If your chamber is reamed to the minimum size (ideally, it should be), but your reloads are not up to snuff, some of your test fire batches will perform better than others. You will have created an unreliable pistol. Don’t ream the chamber again. Instead, improve the quality of your reloads. Double-check against factory ammo.

Remember that a pistol with a minimum-sized chamber should be reliable with factory ammunition. “Reliable,” in this context, means fewer than one failure per 1,000 rounds, with a cleaning every 200 rounds. You want to ream the chamber just enough for the pistol to perform consistently, and not a bit more.

Jarvis Gunsmithing, Inc. of Hamilton, Montana, makes a replacement barrel and bushing combination for the Beretta. You must ream your slide to accept the barrel and bushing, and once you have you must use the Jarvis barrel and bushing.

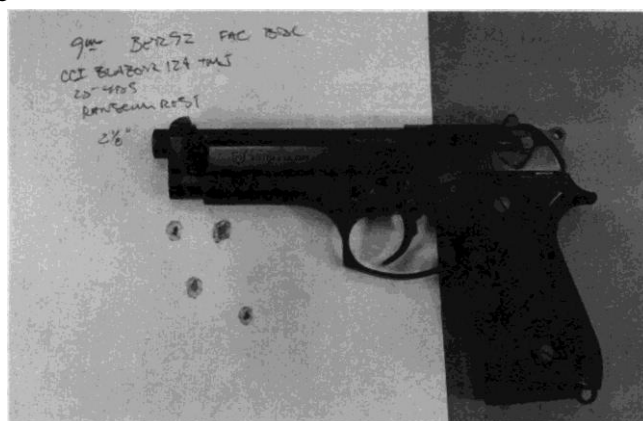
Position the reamer in the slide according to instructions, and ream out the front of the slide to fit the bushing. The Jarvis bushing is a tapered cone that threads onto the Jarvis barrel. Fit the barrel in the normal fashion, then ream the slide. Take the bushing and screw it down on the barrel in half turns, checking to see when the barrel no longer closes and locks. Stop, and back the bushing out a quarter turn.



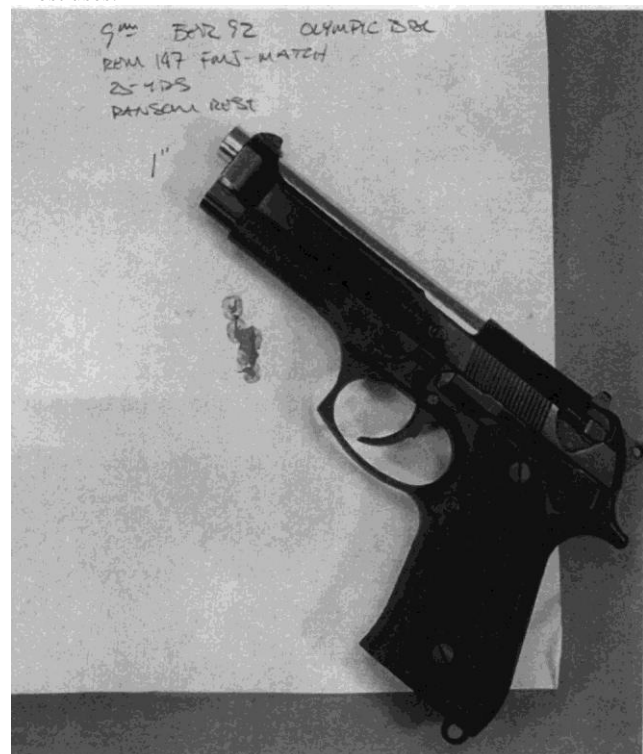
Here is the Jarvis barrel, with bushing and instructions.



Here you can see the bushing on the Jarvis barrel. The bushing swells towards the muzzle, and as you screw it down the fit to the slide gets tighter.



With groups just over two-inches across, this Beretta is accurate enough for most uses.



But changing the barrel to an Olympic match barrel makes such a dramatic improvement, why not switch? Especially if you can get your hands on a supply of the Remington 147 grain FMJ match ammunition.



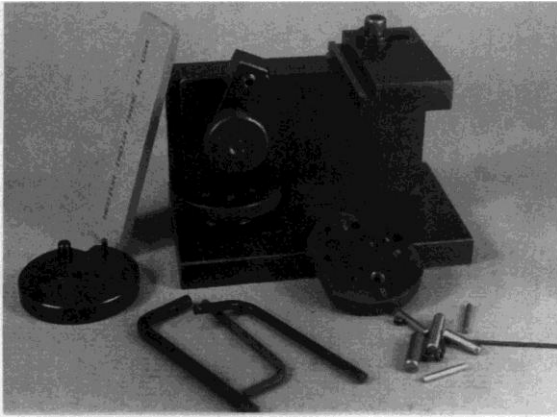
To install the Jarvis bushing barrel in a Beretta, you need to ream the end of the slide. This fixture clamps in the frame, and guides the reamer to cut the slide.

Properly fitted, a match barrel for the Beretta delivers accuracy enough for even the most demanding competitor.

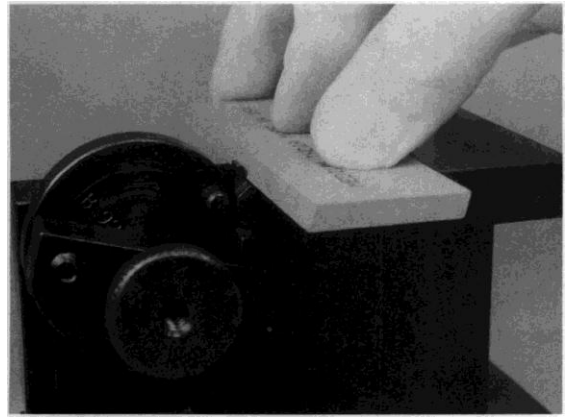
The trigger is another story.

Designed as a service pistol, the Beretta has a heavy trigger pull. In single-action, the trigger is not just gritty but requires noticeable travel of the sear from the hammer hooks. The Department of Defense service manual accepts a single-action trigger pull as high as 6.5-pounds. This built-in "accident-proofing" makes it difficult to shoot the Beretta both quickly and accurately. Like most other service pistols, it needs some TLC to perform for competition.

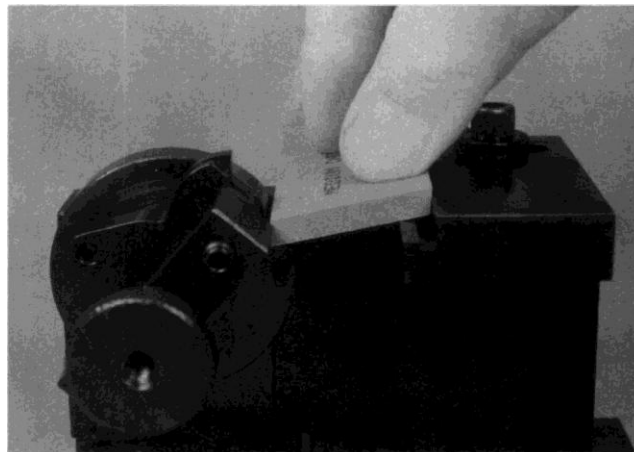
In double-action the trigger is not a problem. I have not seen a Beretta yet where the double-action needed stoning work. The only thing you can do to the Beretta to improve its double-action stroke is disassemble the trigger mechanism and give the DA bearing surfaces a treatment of Brownells Action Magic II.



To stone the hammer and sear of the Beretta M-92 properly you need a fixture such as this Powers stoning fixture.



This is the sear being stoned.



The fixture must be re-set to stone the hammer.

The single-action is something else.

To stone the single-action of the Beretta properly you must have a stoning fixture. I recommend the Powers Series II. It lets you set the hammer and sear angles for proper let-off without making the engagement unsafe. Stoning without a fixture is an invitation to buying replacement parts.

Disassemble the frame and set the sear in the fixture. Adjust the angle. Use magic marker or Dykem to coat the entire width and depth of the sear's face. Once the ink dries, make a single pass with the medium/fine stone. Check your Dykem. If you have the face evenly stoned, the ink will all be gone. If markings remain, carefully re-stone the face. When you have a clean face, switch to the extra fine stone, and polish to a gleaming surface.

With the sear stoned, re-set the fixture to stone the hammer. Apply Dykem to the hammer hooks. Stone the angle of the notch with the medium fine stone until the whole notch has been stoned. Then use the extra fine stone to finish the polishing.

When you reassemble, use Chip McCormick's Trigger Job on the sear and hammer notch.

With proper stoning and polishing you can reduce your trigger pull to a crisp and clean four pounds. A pull lighter than this is not likely to improve your shooting.

Grips

The trigger bar is outside of the frame on the right side, under the right grip panel. If you tighten your grip panel enough to bind the trigger bar you can interfere with the trigger pull. When you fit new grips to the Beretta you must check the clearance between this bar and the new grips.

There's some history attached to Beretta grips. The first government-procured pistols had a problem with slides breaking. In some cases the rear half of the slide would come off the frame. Critics of the Beretta referred to this as "ballistic disassembly," and I can't really disagree. There was, of course, a government inquiry which resulted in the following changes: The government made ammunition according to spec, and Beretta changed the slide and hammer pivot pin on all models.

The head of the hammer pivot pin was enlarged enough to protrude into the bottom of the slide. To clear the enlarged head, a slot was milled in the slide's left side. Now, if the slide breaks the broken half will wedge against the larger hammer pin head and halt.

But what about grips, you ask. Older replacement grips come without head clearance holes. These grips won't clear the new pin. Use a carbide cutter in a hand-held grinder to create this hole. Because the grips are thin you must be careful that you don't break through them or overheat them from cutting too vigorously.



The change to the large-head hammer pin also required a change in the grips. You can modify the old grips to fit the new guns, but it is delicate work.

Reversing the magazine catch

The Beretta magazine catch is designed to work from either side. The safety has a levers on each side of the slide. Moving the magazine catch to the right side makes the Beretta very friendly to left-handed shooters.

To swap the mag catch, remove the slide and grips from the frame. Put your thumb on the back of the magazine catch and push into the frame. With the button pushed in, pivot away from the muzzle. The magazine catch assembly will drop out. Reverse the assembly and insert it through the frame from the other side. Push the tip of the button into the hole to compress the spring. When you can push the rear of the magazine catch down into its seat in the frame, press the entire assembly into place. You will hear a definite click when you are done.



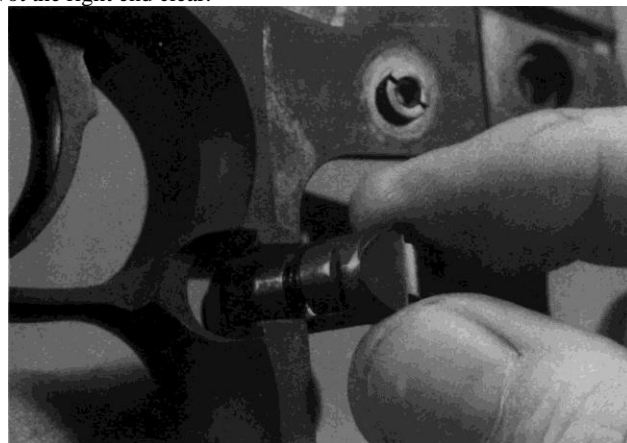
The magazine catch on the Beretta M-92 is reversible.



To switch from right-hand to left-hand magazine release, begin by pushing the right side of the button until it clears the inside of the frame. Pivot the right end clear.



Pull the mag catch out on the right side.



Switch the button to the other side and insert it through the grip panel opening. Catch the spring against the far shoulder.



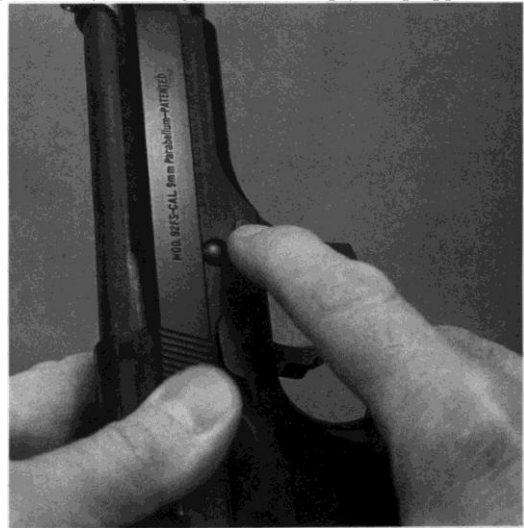
Press the magazine button into the slot until it clicks in place.



The Beretta Combo has both a 9mm and a 40 S&W slide and barrel assembly. It's easy to change calibers, simply swap uppers.



The frame is marked on the Combo. If you see this, ask where the other upper is.



To disassemble the Beretta, press the lever lock in from the right side.



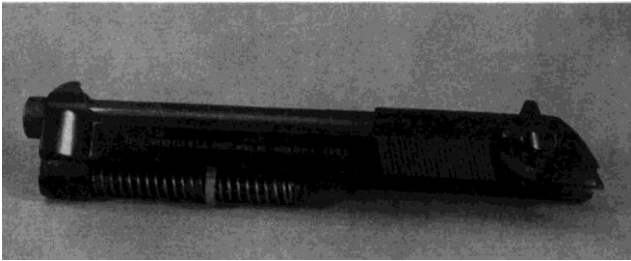
With the disassembly lock pressed in, rotate the lever down.

Recoil systems

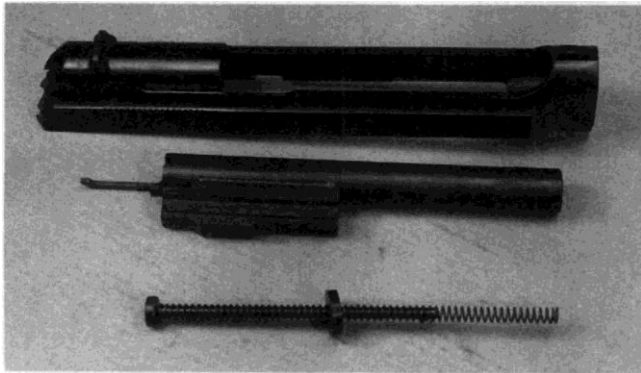
To reduce wear and tear on the Beretta, install a dual-spring recoil system like the Chandler Arms or Sprinco. One of these, along with shock buffers will take the shock out of shooting 9mm +P or .40 S&W ammunition.

The switch-top Berettas

Lower cost, lighter recoil, and practice without switching to a different pistol? Not a problem with the Beretta. The Beretta Combo, a pistol with slide assemblies in 9mm and .40 S&W is the ticket. You can practice with cheaper and softer recoiling 9mm, but compete or carry with the .40. The only difference between the combo and my M-92 was the ejector. The Combo is fitted with a .40 ejector. I tried the .40 slide assembly on my 9mm, with its 9mm ejector, and didn't have any problems. What if 9mm is not cheap enough or soft-shooting enough?



The Beretta slide assembly, with a buffer over the spring.



The conversion kit does not have any locking block, and the ejector is part of the barrel. The slide has no safety.



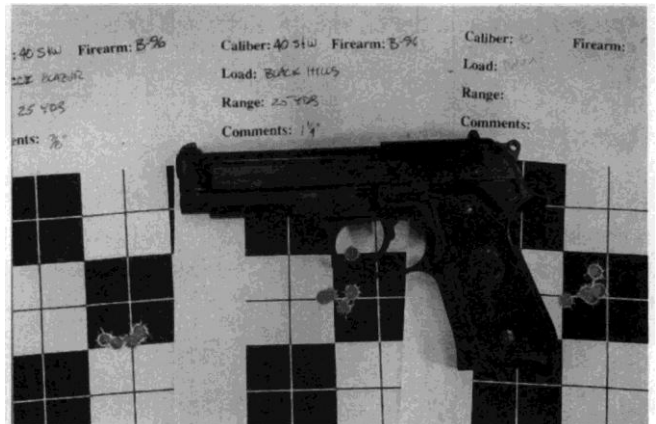
Mike shooting the Ceiner conversion. In an hour, 500 rounds went downrange. This can be addictive.



With a Beretta Combo and a Ceiner conversion kit, you can shoot any load in three different calibers.



The Ceiner .22 conversion kit slides right onto any Beretta M-92 or 96.



With groups like this, I don't think installing a match barrel will make much of a difference.

For most of us, the biggest obstacle to improved shooting is the cost of ammunition. Jonathan Ceiner has developed a .22 conversion kit that lets you use cheap rim-fire ammo in your Beretta. Sale-priced .22 ammunition costs 15 percent of 9mm ammunition. It is even cheaper than reloading your own.

The kit is a complete upper assembly of slide, barrel and recoil spring, and comes with a magazine for the .22 ammunition. Since the .22 does not have enough power to work the locking mechanism and heavy slide of the Beretta Ceiner makes his slides out of aluminum. The barrel does not lock to the slide. Because of cost consideration the slide lacks a safety.

Exercise caution when using the conversion unit. You cannot put the pistol “on safe.” Remember the first rule of safety: All guns are always loaded. If there is a time when this rule is especially true, it is when using this conversion kit.

Remove your 9mm (or .40) slide assembly and replace it with the conversion assembly. Load the magazine. You are ready to shoot. Although the same size as a 15-round 9mm magazine the conversion magazine only holds 10 rounds of .22 long rifle. Even if present law allowed magazines to hold more than 10 rounds, getting a magazine to feed more of those little rimmed .22's would be difficult.

As with other .22 pistols, the conversion kit I tested showed definite tastes in ammunition. Once you find an accurate and dependable brand of ammunition, stock up and shoot all you want.

Chapter 18 - Basic Pistolsmithing The 1911

When the Colt .45 Automatic was first called the 1911, planes flew more slowly than we now drive on freeways, cars had wooden frames and were started with a crank, and what illumination there was in houses came from gas. The Titanic was growing in a shipyard. William H. Taft was President of the United States. Today, all are gone, save the 1911 pistol.

Through all the decades there have been two distinct camps among those objecting to the 1911: those who fault its accuracy, and those who fault its reliability. There are also those who have complained of its heavy recoil, but in this age of magnum cartridges, the .45 is viewed as something of a pussycat. Besides, if the .45 really is too much for you, simply have your 1911 chambered in other, softer-recoiling calibers.

The truth about the 1911 is simple: The longstanding objections to it have never been a response to the gun itself, but to its use. Those “unreliable” 1911’s? Hand-fitted target pistols used for seriously accurate bull’s eye competition. The “inaccurate” 1911’s? Ultra-reliable, but so-loose-they-rattled military pistols. The target shooters didn’t care about reliability, and the military wasn’t interested in accuracy. The pistols performed exactly as required.

The need for accuracy combined with reliability didn’t come up until the development of IPSC. You can’t win an IPSC match with an inaccurate pistol. Misses not only don’t help you, they hurt you with penalty points. Nor can you win with an unreliable pistol. If you have a malfunction, you cannot stop and start over again after you have solved the problem. You must continue. One second in the time of a stage can mean the difference between winning and losing. Ten seconds lost in clearing a malfunction are a disaster.

The good news is simple: You can have both reliability and accuracy in the same pistol. Since improving reliability is easier, we will start with that and go to accuracy later.

Testing the reliability of your 1911 involves taking it to the range and putting many rounds through it. Use a top quality, standard-length (seven- or eight-shot) magazine such as a Wilson, Brown, McCormick, Mag-Pack, Mec-gar or Pachmayr. Start with factory hardball. Put 200 rounds through your pistol. If you have no problems strip and clean your pistol and go to the next test. If you do have problems go directly down to the section on performing a reliability package. Do not clean your pistol.

Some shooters like to brag about how many rounds they have put through their pistol without a cleaning, as if this were some sort of test of reliability. It isn’t. All it really tests is how long you can go before your luck runs out and you cause some serious damage. Two hundred rounds, whatever your intended use for your pistol, tests reliability. You are not going to be in a gunfight requiring anything close to 200 rounds. You are not going to shoot in a match requiring more than 200 rounds before cleaning.

If your pistol is intended for defense and has passed the first test switch to hollow-point ammunition. All the current high-tech hollowpoints perform admirably. Buy at least two brands and practice with each. Purchase 200 rounds of whichever brand feeds reliably and shoots accurately in your pistol. Repeat the test.

If you are using the pistol for competition, you will probably be reloading your ammunition with lead semi-wadcutter bullets. Test fire at least 200 rounds of your match or practice ammunition.

If when you switch to the hollowpoints or the lead bullets reliability suffers, then roll up your sleeves, for you have some work to do. Do not clean your pistol. You’ll need to see the brass marks left behind by the cases.

Reliability package

Disassemble the pistol and look closely at the breech face, the extractor and the tip-over edge of the chamber. Factory machining usually leaves toolmarks on these parts, and the marks cause friction. The friction rubs brass from your cartridges and leaves a noticeable deposit behind. You must remove these toolmarks and reduce the friction.

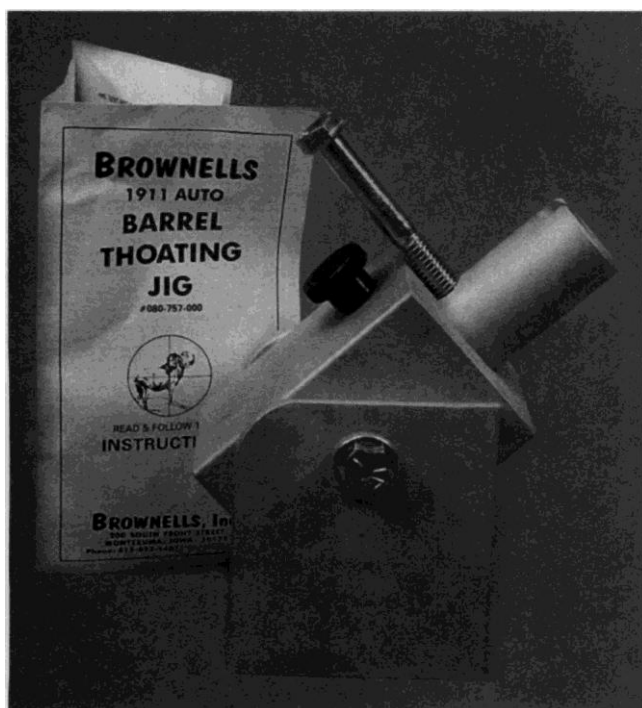
Remove the extractor and slightly round and polish the bottom of the hook. Polish the inside face of the hook, where the cartridge rim bears. On the slide, stone the side of the breech face under the extractor hole. Stone the sidewall of the breech face opposite the extractor. This area is often the critical source of friction, and removing the toolmarks here clears up 90 percent of your reliability problems.

Should you polish the feed ramp? Only if you want to. Unless the toolmarks are huge (HUGE!), polishing the feed ramp has practically no effect on how well your pistol feeds. If you must polish the ramp, do not round off the top edge of the feed ramp in the frame. Doing so will instantly turn your pistol into a non-feeding 1911, in dire need of a weld and re-cut ramp job.

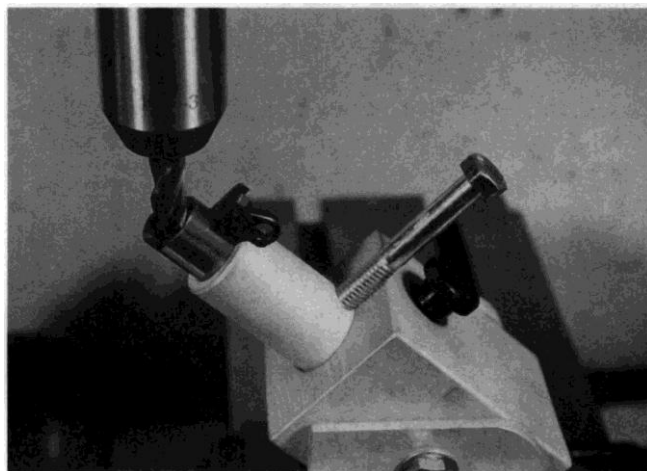
Very old pistols have narrow barrel ramps meant only for hardball. To feed hollow-points or semi-wadcutters you must open the ramp or buy a new barrel. Base your decision on how well the pistol works.

If the current barrel is accurate, cut the ramp. If the current barrel is only average in accuracy (three-inches or greater at 25 yards), don't cut the ramp. Instead, spend your money on a better barrel. All currently-produced barrels come with the correct ramp configuration.

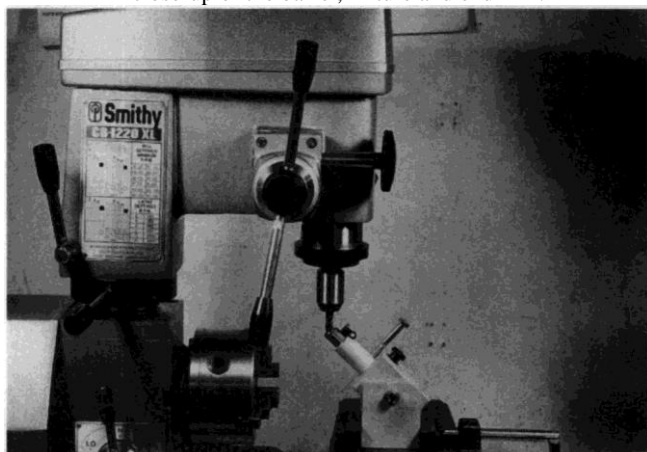
Cutting a ramp is best done with a ramp-cutting fixture. Lock your barrel in the fixture and clamp the fixture in a mill or drill press. Cut the ramp. If you have an experienced, steady hand you can do the job with grinding stones in a hand-held grinder, but you risk marring the angle between barrel and feed ramp. Use of the fixture eliminates the possibility of this damage.



Here is the Brownells barrel ramp throating jig. It allows you to cut a new ramp without making an mistake.



A close-up of the barrel, fixture and end mill.



The Brownells fixture set up to cut the feed ramp on a barrel.

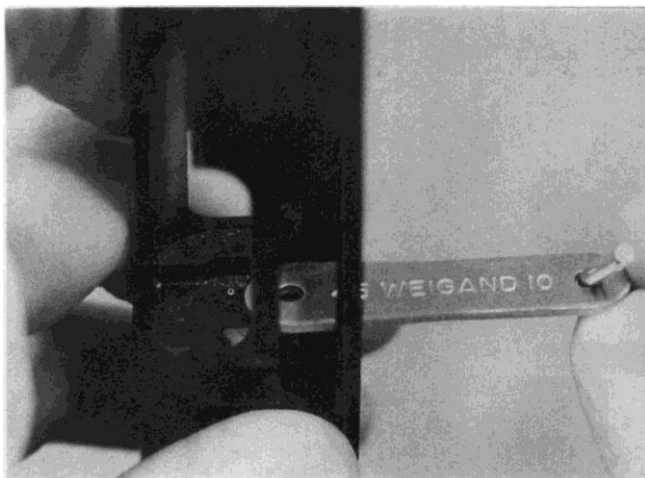
Once you have cut the barrel ramp use an extra-fine stone on the tip-over edge of the chamber. Clean the slide and reassemble it. Use an extractor tension gauge to measure the tension of your extractor. Record the reading for future reference. Repeat the test your pistol failed.

If you still experience feeding malfunctions at this point in the process you should use the malfunction guide in Chapter 11 to hunt down the specific problem. More than 95 percent of 1911 pistols will feed perfectly after a reliability package.

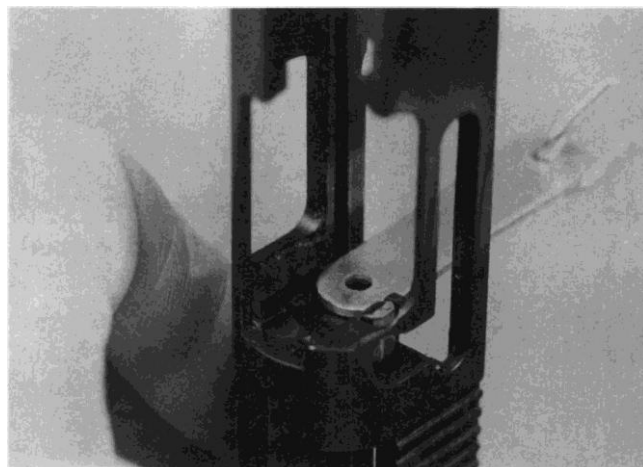
Fitting the extractor

The 1911 has always had a small but persistent problem with the extractor. Take a flat piece of steel. Bend it. How much tension have you placed on the steel at the bending point? Good question. So it is with the extractor, which, after all, is just a flat piece of steel with a bend in it. The amount of tension this bend creates is critical. Is there a specific, single best amount of tension? No. There are upper and lower limits, and for each pistol there is an acceptable range.

The old method of “measuring” extractor tension involved taking the slide off the frame and removing the barrel. A loaded round was stuffed in the breech face to be held by the extractor. If the round fell out there wasn’t enough tension. It wasn’t what you’d call a precise test.



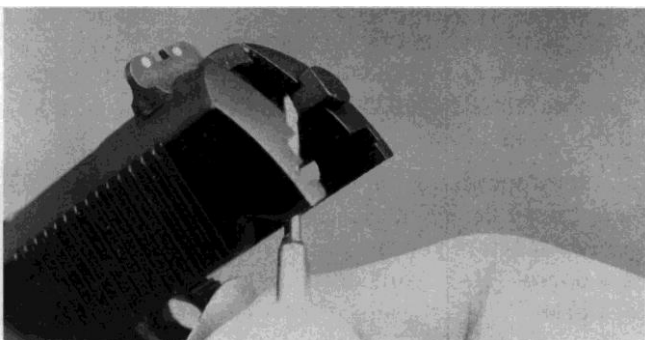
Check extractor tension with a tension gauge and a trigger pull gauge. Slide the gauge under the extractor....



record how much force it takes to remove the gauge from the extractors grip.

The new and better method is to use an extractor tension gauge. With the pistol disassembled, slip the gauge under the extractor. Pull it out with a trigger pull gauge. The amount of force needed to slide the gauge out from under the extractor is your tension measurement. Record this, and save it with your pistol. Check the tension every 1,000 rounds or so, and if the measured value starts to decrease, increase tension, (see below)

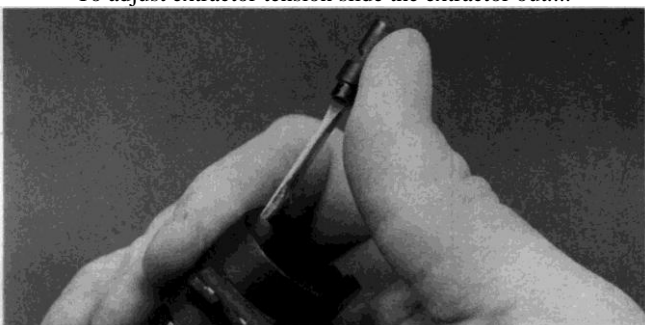
While the old way to “test” extractor tension was poor, the old way to increase tension on the extractor still works. Disassemble the slide and pull the extractor half-way out of its tunnel. Rotate the extractor 180°. Bend it slightly with your thumb, pushing its tail away from the firing pin tunnel. Turn it back around, slide it into place, and with the firing pin and retaining plate in the slide, measure the extractor tension. If the tension is not back to its old value, repeat, pushing harder this time. You can also bend the extractor in your vise. Remove it from the slide. Open your vise jaws one half-inch and gently close them on the front of the extractor. Using the vise to hold it, bend the rear of the extractor.



To adjust extractor tension slide the extractor out....



turn the extractor around....



and press the end away from the slide.



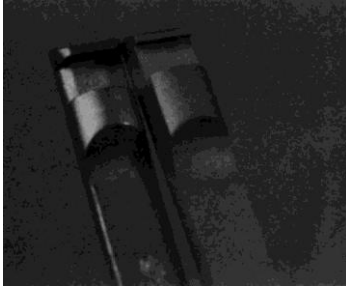
The extractor is meant to do a spring's job, and it should be made of spring steel. This Bar-Sto extractor is.

If your extractor becomes too troublesome, losing its tension every few hundred rounds, replace it. Irv Stone III of Bar-Sto believes that many problems with the extractor stem from the alloys used in manufacturing. He has a set of blueprints for the Match 1911 that date before WWII; the specifications for the extractor call for spring steel. Irv notes that many current extractors are made out of tool steel, an alloy that does not resist fatigue as well as spring steel. He makes his extractors out of spring steel.

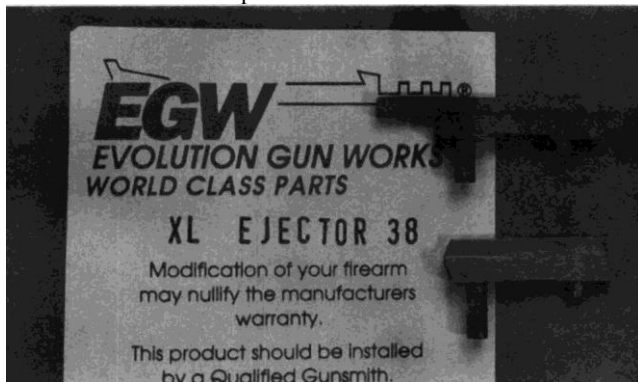
To fit a new extractor, remove the old one and clean out the extractor tunnel. Check the bottom of the new hook; it should be slightly rounded, just enough to smooth the extractor's trip over the cartridge rim. Round the hook too much and you decrease its gripping area. Polish the hook and the rim recess, as above.

Slip the extractor into the slide and check the fit of the retaining plate. Remember, it must hold the extractor firmly. A too-large plate can be filed along its edges until it will slip into the slide. A too-small plate will allow the extractor to wobble in the tunnel. While dimpling the plate's edge with a centerpunch or peening it can keep a too-small retaining plate from falling out of the pistol, it won't help support the extractor. Get an oversized retaining plate, and fit it to the slide and the new extractor.

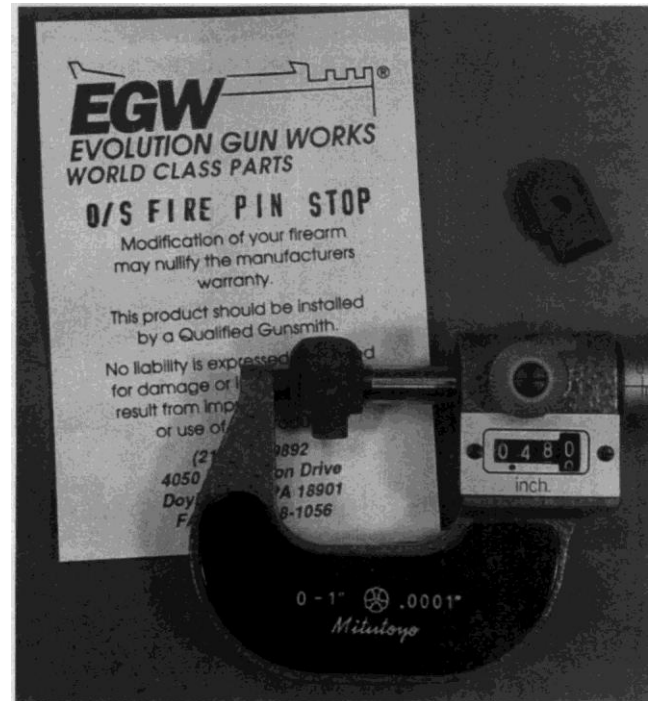
Adjust the tension on your new extractor to match the setting the old extractor had when it was working properly. Test fire. If you see the cartridges feeding hard or even hesitating before camming over the tip-over edge, reduce the tension and test again. Do not reduce the tension too much or your empties will not eject well.



When installing an extractor, make sure the lower corner and lower edge of the hook is rounded and polished.



The standard ejector below, is designed to toss empties up and out. The extended ejector above is designed to toss the empties to the side.



If your firing pin retaining plate is loose and drops out, or it does not provide a firm fit to the extractor, replace it. The standard plate is .465-inches wide. This oversized one is .480 wide, and must be filed before it will slide into place.

Installing the new ejector

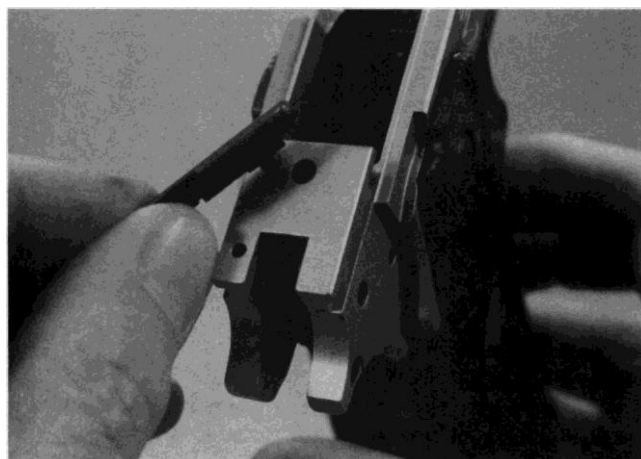
Even with correct extractor tension, sometimes a new extractor combined with the old ejector can cause weak ejection. Installing an extended ejector will increase ejection force and distance. Begin by measuring the sidewall of the ejection port. If it is higher than .490-inches you may find that better ejection will dent your brass. You will have to lower the ejection port, see below.

Ejectors are caliber and model specific, with the slide slots in slightly different locations. You will not be able to fit a .45 ACP ejector into a slide for a .40/10mm or a .38 Super/9mm. Likewise, the Government Model and the Commander slides take different ejectors. When you order a new ejector specify both the caliber and the slide length.

To remove the old ejector, use a drift punch and drive the retaining pin out of the frame. Clamp the ejector in your vise, and tap the frame off. Discard the old ejector. Check the fit of the front leg of your new ejector to the frame. It should slide easily into the hole. Now press the ejector down into both holes. Don't worry if you have to tap gently with a hammer; you want the ejector to fit snugly.



The ejector sits in two holes, the long leg goes in front.



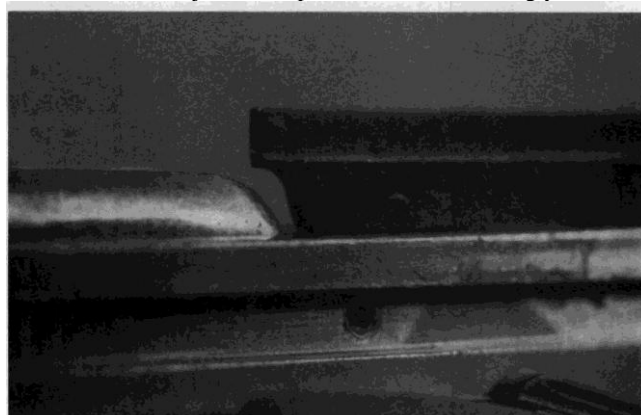
Check the front leg first.



Press the ejector into place to see if it fits snugly.



The magazine not supposed to come near the ejector.



Make sure your new ejector does not touch the magazine when the magazine is pressed up as far as it will go.

If you have checked the fit of both legs of your ejector and found it slightly loose, remove the ejector and bend the front leg by tapping it with a hammer. Replace the ejector in both holes and recheck the fit. Continue your gentle bending until the ejector doesn't move when you press it into both holes.

With the ejector in the frame, but not secured, press a magazine into place. Check to see that the magazine is not touching the ejector, even when pressed up past the locking point. If your ejector is sitting too low over the magazine well it will get pasted every time you slam a magazine into place— bad for both the magazine and ejector. File the underside of the ejector until the magazine clears.

Check the tip of the ejector. If the manufacturer shipped the ejector with a point on it, leave it alone. Most manufacturers, however, leave the tip square. You must profile it yourself. Gently bevel the corners. The beveled edges lever the brass out of the slide without putting extra stress on the extractor.

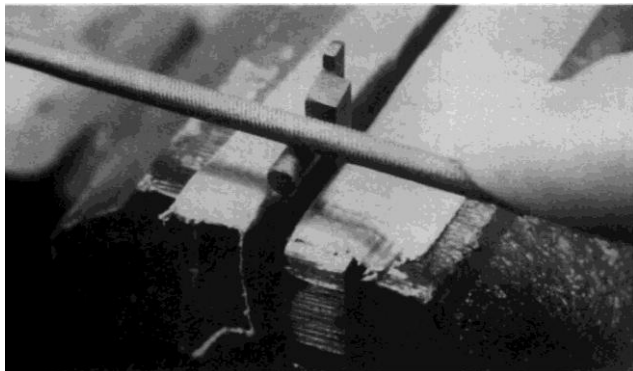
Fit the retaining pin. Do not think of simply drilling through the hole. Your drill is too small to withstand the lateral load, it will flex, and you will make a mess of your frame. You may even break the drill, and be in a real pickle.



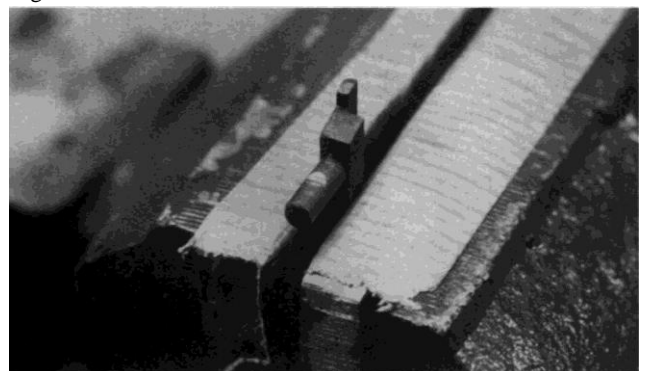
If your extended ejector comes to a point, leave it alone. If it comes square, slightly bevel the edges of the tip.



To insert the retaining pin, you have to measure the distance down, and remove the ejector to file the leg. You cannot drill through the hole and the leg.



File the front leg of the ejector at the measured and marked location.



Once filed, you can replace the ejector and its retaining pin.

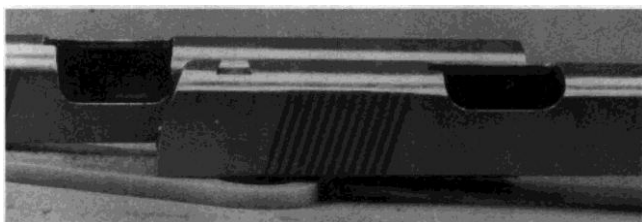
Pull the ejector out. Measure the distance from the frame top down to the retaining pin hole, and use a round file to cut a clearance notch in the ejector leg. Check the fit regularly. Once the pin will fit, drift it in. You can live without the retaining pin, but every time you clean the pistol you'll run the risk of losing the ejector down the drain.

Check that the slide, without its recoil spring or barrel attached, will fit over the new ejector. It should. If it won't, gently file the ejector until the slide clears.

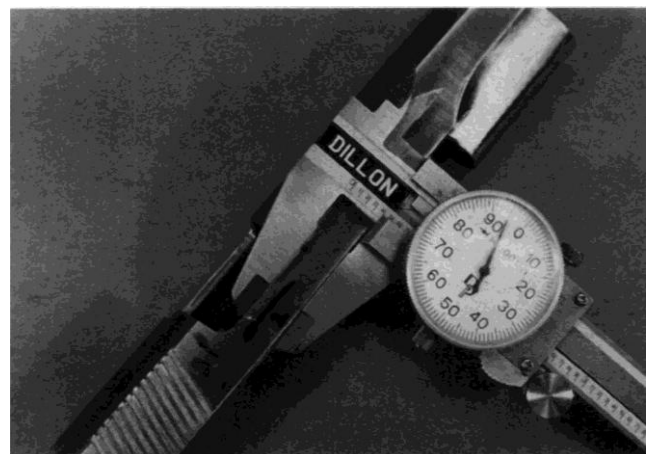
Assemble the pistol and test-fire. Your empties will now eject with greater vigor.

Lowering the ejection port

With your new extractor and new ejector briskly flinging the brass out of your pistol, you may find that your old ejection port is now too small. If you are seeing bent empties, brass marks on the lower rail of the ejection port, or an occasional empty that stays around to gum things up, you will need to lower your ejection port.

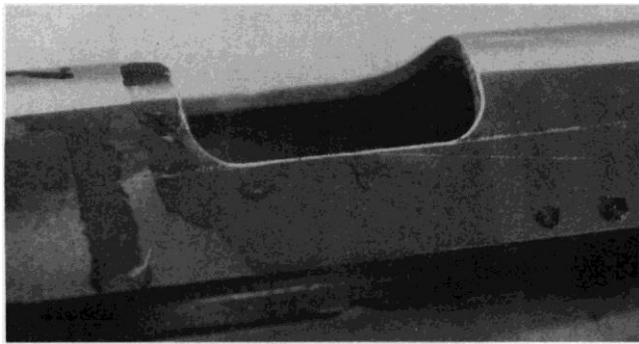


Here you can see the difference between the old ejection ports and the new, lower port.

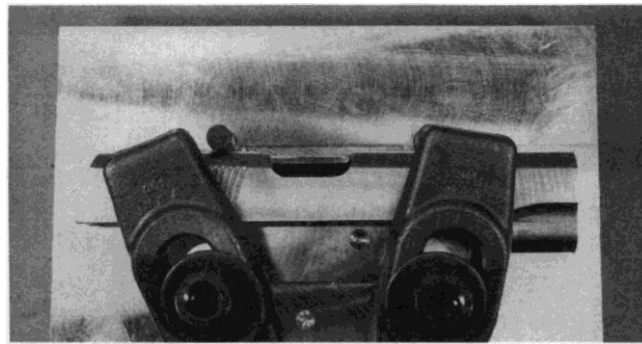


This port has had the sidewall lowered to .395-inches, this is more than is needed, but not so much it will be too thin.

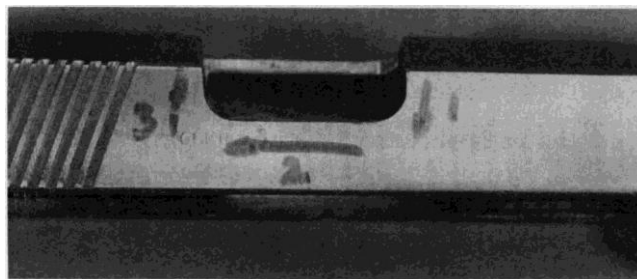
Ejection ports used to be much smaller than they are now. When first designed, the ejection was intended to be upwards, and the sidewall of the slide at the ejection port was as much as .550-inches high. Current production leaves this dimension between .450 and .475 inches, still too high for brisk, reliable ejection.



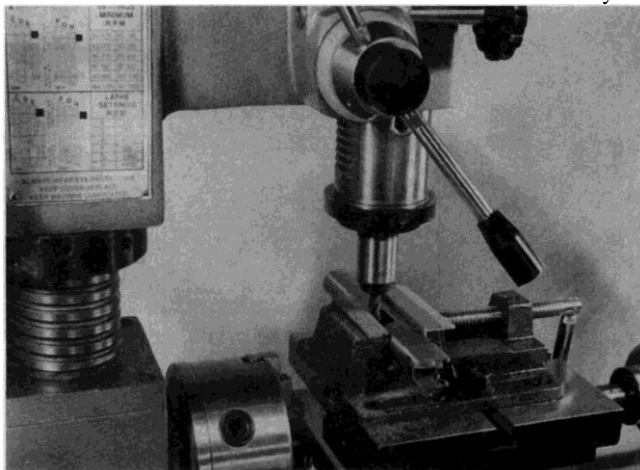
Here is another slide with the limit line marked in Dykem and the port cut to the line.



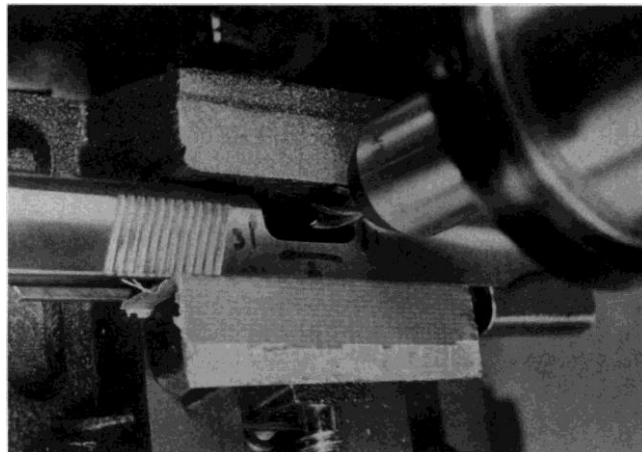
This is EGW's "The Plate" set up to mill a lowered ejection port on this 1911 slide.



The order and direction of your milling cuts to lower the ejection port.



Here is the slide set up in the mill, ready for the cuts.



Bring the cutter to the right until it touches the ejection port, then down, left, and up.

A proper height for the sidewall is around .415 inches, but the steel of a slide is too tough to hand file to this measurement. You will have to use power, and for this job, a mill works best. Take the slide off of the frame. Remove the barrel, recoil spring system, and extractor. Lock your dial calipers to the final sidewall height, and use it to scribe a line below the current ejection port. Clamp the slide in the mill vise with the right sidewall up and level. I find a 3/8-inch cutter leaves the corners a smaller radius than the factory cutter—a look I like. If you don't, or feel this is too small, use a cutter up to 1/2-inch.

To save time later in hand-blending discrete cuts on the ejection port your cutter will travel in a "U" shape. Lower it into the port and run it towards the muzzle until it just touches the front edge. Move it towards the line you have scribed. When the cutter reaches the line, move it towards the rear of the slide. When the leading edge of the cutter gets to the rear edge of the ejection port, move it back towards the top of the slide. You have just completed your "U". Lift the cutter up out of the slide, stop it and inspect your work. If you need to remove a few more thousandths, follow the same "U".

The mill will leave the edges of the ejection port burred, and the lower rail square in cross-section. You must clean up these flaws. Remove the slide from the mill, and clamp the back half of it in a padded vise. With a carbide cutter or small stone in your hand-held grinder bevel the inside lower rail of the ejection port. Polish the bevel smooth with 220 grit cloth. Take your needle files and de-burr the port edges. Move up to 600 grit cloth, and polish the filed edges and bevel. All this grinding and polishing will push a large amount of grit into the extractor tunnel. Scrub it before you reassemble. As a temporary protective measure, cold blue or heat blue the fresh edges.

If you do not have a mill, you can do the whole operation with a carbide cutter in a hand-held grinder. To prevent overheating the cutting tool, do not bear down heavily, and do not cut for more than 15 seconds at a time. Move the cutter in smooth, even strokes from front to back. Do not stop moving while in contact with the slide, for the cutter will continue to cut, and you will be left with a divot to blend with the rest of your cuts.

Once you are down to the scribed line, clean the slide off. Use your pillar file to smooth and even the lower line of the ejection port.

With the hand-held grinder, bevel, de-burr, and polish, as above.

Match bushings

To allow proper and reliable function in adverse conditions, the barrel bushing on military 1911's was made a loose fit. Wet, frozen, muddy, or even rusted pistols will continue to function if their barrel bushings are loose, and since only a functioning pistol can save a life, loose bushings make sense for military applications. If you anticipate living in a hole, and needing your pistol in dire emergencies, you may want to keep this loose fit. Otherwise, replacing the loose bushing with a tighter-fitting one can improve accuracy without decreasing reliability.

How tight should the bushing be? The question has been asked ever since Browning designed the 1911.

To check the bushing and barrel fit, remove the barrel and slide the bushing up and down. If it is tight enough to bind, the pistol will not be reliable. Loose enough to feel play, and the pistol will lack accuracy.

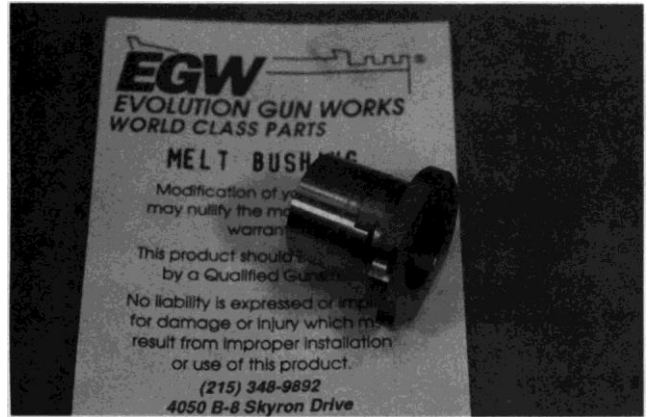
The fit of the bushing to the slide is an argument that will rage on as long as shooters use the 1911. Bull's eye shooters feel that the bushing should be so tight that it can be removed only with a bushing wrench and lots of muscle. Defense-minded shooters who favor the 1911 feel that if you can't remove the bushing from the slide with just your fingers, it is too tight.

I fall in the middle. I fit the bushings on my 1911 pistols to be tight enough that I can disassemble them with my fingers if I have to, but tight enough that a bushing wrench is a comfort to use. I like accurate pistols, but not if they are so tightly fitted that they become unreliable.

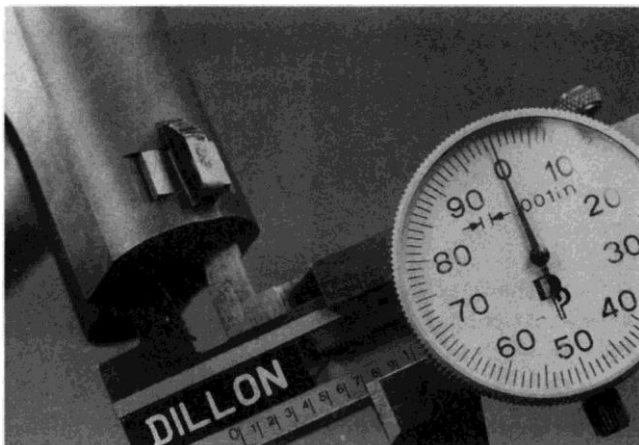
Before the abundant variety of after-market parts your choices of bushings were two: the loose, military one, or an over-sized bushing that had to be machined to fit both the slide and barrel.

Not anymore. There are so many choices today that to fit a new bushing you only have to measure the inside diameter of your slide and the outside diameter of the barrel at the muzzle.

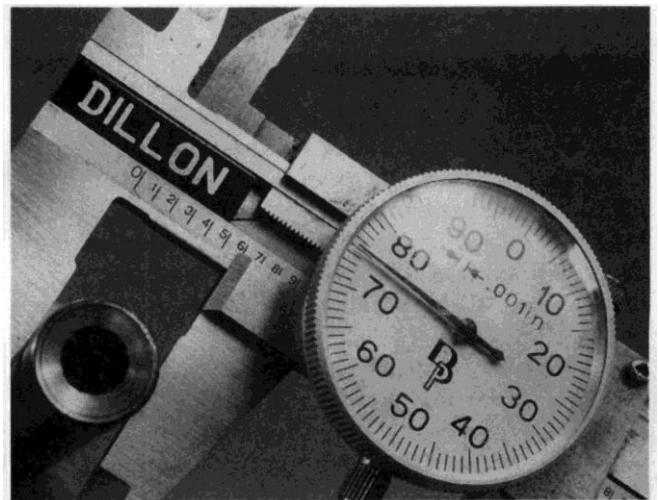
You can buy bushings for the 1911 with external diameters from .697 to .705 inches. They are available in increments of .001 inch. Measure the inside diameter of your slide and order a bushing at—or just under—the measurement. When it arrives, check the fit. If the bushing slips in place, you are done.



If you are going to de-horn or melt your pistol, start by fitting a "melt" bushing to the slide. Bevel the bushing instead of the slide.

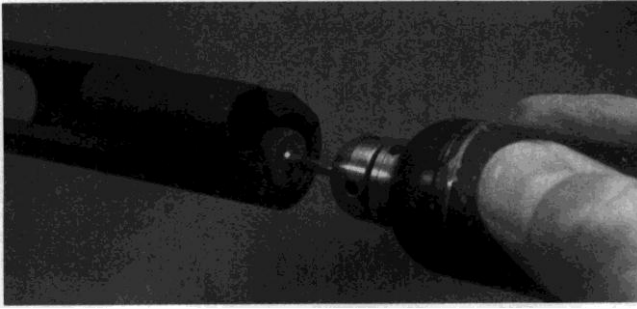


Measure the inside of your slide when ordering a replacement bushing. It is easier to ream the inside of the bushing than turn or polish the outside.

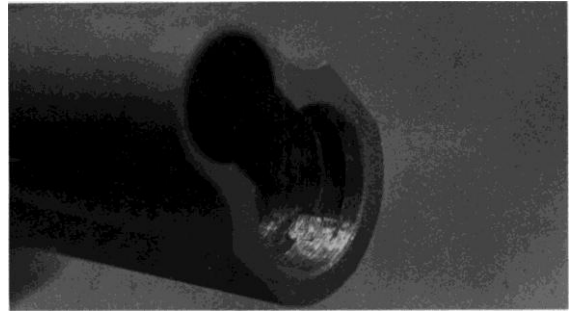


Measure the outside of your barrel, if you will be using the old one.

If the bushing needs force to slide in, set it aside and pull out your hand-held grinder. With a rubber polishing bob ground down to .600-inches polish the inside of the slide, starting at the muzzle end and continuing for one-inch. While you are polishing off the high spots, do not round the edges of the bushing slot.



Here a hand-held grinder and polishing bob are being used to polish the inside of the slide.



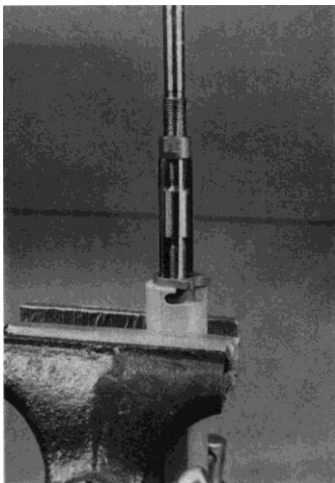
If the front sight tenon binds the barrel bushing, grind and polish it down.

If you do not have a hand-held grinder you can use slide fitting paste or grinding compound to fit the bushing. Slather 600 grit on the bushing and into the slide. Force the bushing into place. Take a bushing wrench and rotate the bushing back and forth. Lap the bushing to the slide until it moves easily, pull it out and clean off the grinding compound.

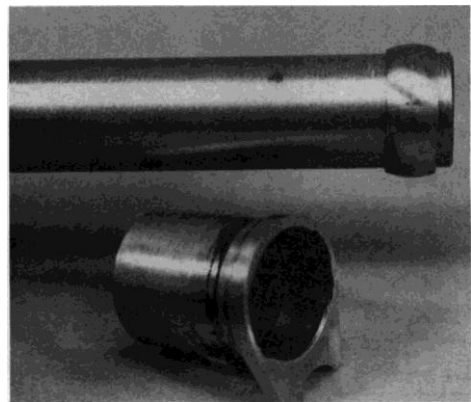
The bushing will slide into place.

Once you have fit the bushing to the slide, turn it all the way into the slide retaining slot and check the fit. Sometimes the bushing lug binds entering the slot. Cover the lug with Dykem and check the fit again. When you have found the location of the binding, file the lug to clear the slot. File carefully! You do not want to file so much that the bushing is loose in the slot.

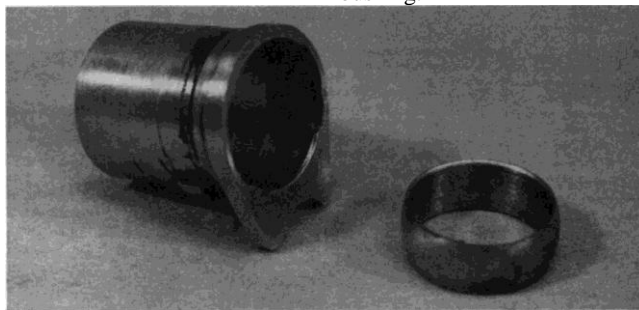
If you cannot order a bushing that is the perfect size both inside and out, then order a bushing that is the perfect size outside, and too small inside. It is easier to decrease the diameter of the barrel a few thousandths of an-inch, or increase the inside of the bushing, than to adjust the diameter of the bushing exterior.



The Wessinger bushing reamer. The reamer is adjustable to ream the inside of the bushing to any diameter.



The Briley bushing ring rides on the barrel. Shown outside of the bushing.

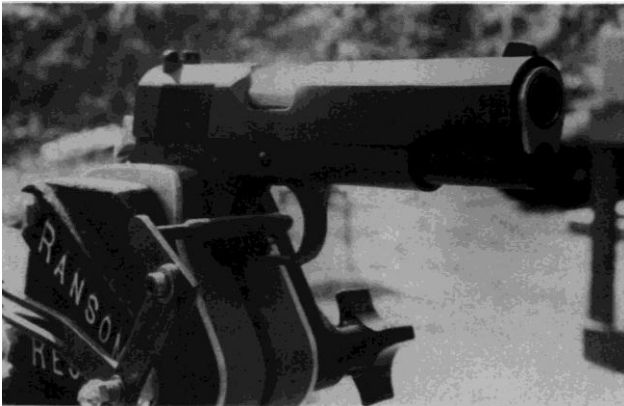


This is a Briley ring bushing. The ring fits in the bushing and the barrel slides through the ring.

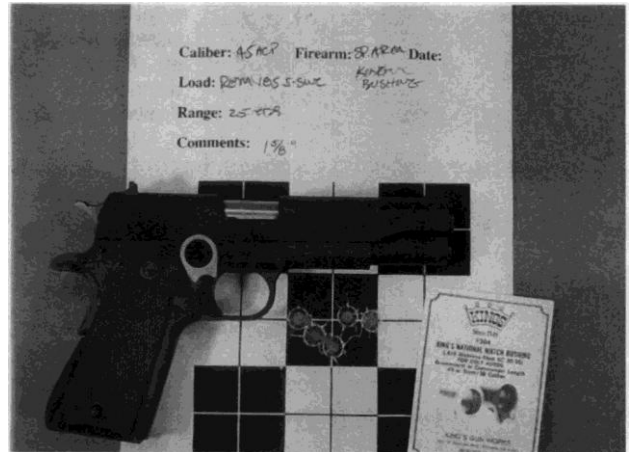
The easiest way to adjust a too-small-inside bushing is to chuck the barrel in a lathe and turn the diameter down until it fits the bushing. If you do not have a lathe but want a tight-fitting bushing, you have to ream the bushing out. You cannot do this in your vise. If you try to, you will either ream the bushing crooked, or squeeze the bushing into an oval shape trying to clamp it and then ream an oval hole. You may even end up with a crooked oval hole! Instead, buy a fixture to hold the bushing and an adjustable reamer.

The Wessinger fixture and adjustable reamer are both available from Brownells as a set. With it you can fit barrels and bushings to each other for a long time.

If all this fitting and adjusting seem like too much aggravation, use a Brileys bushing. Their bushing is designed and made as two pieces. The external piece looks like a standard bushing. Nestled inside the bushing is a ring that looks like a large wedding ring. The barrel rides in this ring. The bushing body comes in two diameters, while the rings come in six different diameters. You order the combination that fits your slide and barrel, and with it you get the performance of a fitted bushing.



With the standard barrel and a Kings match bushing, the Springfield showed improved accuracy, and greater consistency. Definitely worth the small amount of work.



The installation of a Kings bushing on this Springfield 1911A1 had a very satisfactory effect on accuracy.

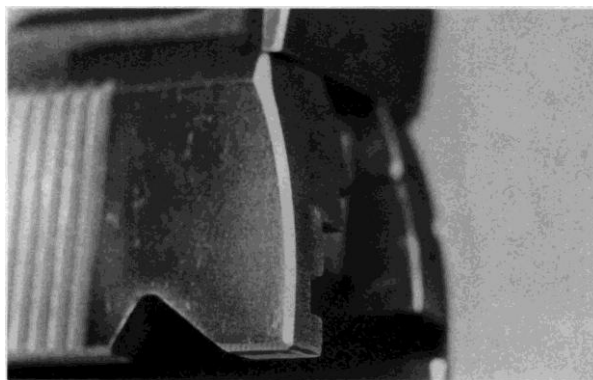
How much do tighter bushings improve accuracy? I tested a Springfield 1911. Right out of the box, the bushing fit was typical for a factory pistol. While you could slightly wiggle the bushing in the slide and the barrel in the bushing, it wasn't too bad. At the range, the Springfield delivered three to four-inch groups at 25 yards. After fitting the Kings bushing to the slide and reaming it with the Wessinger tool until the barrel fit properly, accuracy improved. While the best groups improved only slightly, the occasional four-inch or larger groups disappeared. The average dropped from 3-1/2-inches to just over two.

Removing sharp edges: Part One

Shooting pistols can be hard work. Loading magazines, picking up brass, trying to hit the target with consistency, avoiding a flinch—these are more than enough to do, without adding pain to the problem. If you find that there is a sharp edge or spot on your pistol that makes shooting uncomfortable, do not ignore it. Remove it. If you are going to carry a pistol for defensive purposes, sharp edges can cut and tear your clothing as well as your hands. Trim your pistol and save your clothes.

In this section we will go over the restrained edge-breaking of a 1911. The more aggressive “melting” done to some carry pistols will be covered in the next chapter.

To locate the sharp edges, run your hands over the pistol. Mark every place that irritates your hand with a felt-tip pen.



When de-horning, a small bevel is your start.

To de-horn your 1911, start with the straight edges and the outside of curves. Use the extra narrow pillar file. On inside curves use a fine half-round needle file. Follow up with 400 or 600 grit cloth. In most cases you will file just enough to “break” the edge, and then remove the file marks with the cloth.

Look at the back of the frame, slide and safety. Many shooters find these edges the most irritating.

I find the back corner of the thumb safety particularly bad. On almost every one made, I must take this corner down to a completely rounded surface. The one safety I have found that doesn't require this work is the Chip McCormick. Also used on the Kimber pistol, the McCormick safety is plenty large enough for competitive shooting and its blended edges work great for concealed carry.

The standard grip safety can be uncomfortable. Some shooters think it is a pain because it is too small. You don't have to race out and install a larger grip safety, though. Just rounding the edges will make it more comfortable.

Now look at the bottom, outside edge of the slide itself. If you use a high hold on the pistol, or have large hands, they can get very close to this edge. If you shoot with your thumb over the safety, the edge can shred your skin right off. I bevel this edge the entire length of the slide, except for the short section between the slide stop notch and the disassembly notch. While some shooters bevel this section, because it is already very shallow I prefer to keep it untouched.

Round the back edges of the slide to keep them from irritating your hands and your clothes.

The main sources of irritation on the top of the slide are the sights and the ejection port. Approach the front sight with caution. Round only the front edges. Since you use the top and rear edges for aiming, rounding these will cause you serious shooting problems. The same goes for the rear sight. Again, round only the side and front edges, not the aiming edges. If you have a Novak sight installed, you won't have to do any rounding. Novaks were designed and made already beveled.

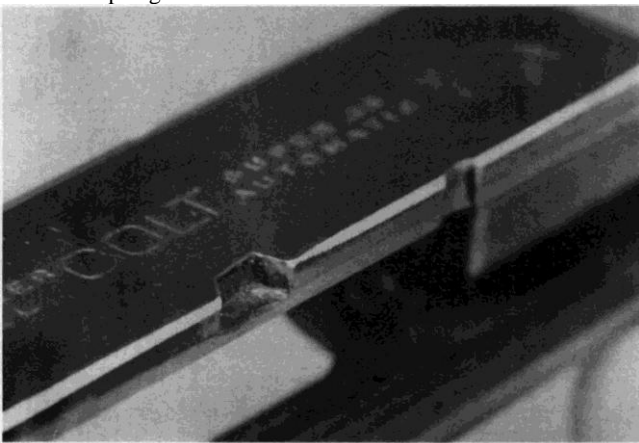
On ejection ports the main culprit for pain or bleeding is the top edge of the right-hand breech face sidewall. This edge, lurking between the cuts for the breech face and the ejection port, often ends up as a needle-like point. Round it. Rounding will save you pain and bleeding the first time you have to clear a malfunction.



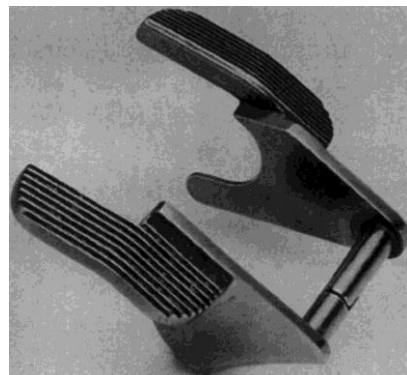
The McCormick thumb safety is sculpted on the rear, and does not present a sharp edge to the shooter's hand.



The grip safety pad rides out from the frame along its entire length, and is almost impossible to not grab correctly.



When you bevel the lower edges of the slide, leave the edge of the hold-open notch its full thickness.



An ambidextrous safety such as this one from Ed Brown is a boon to left-handed shooters. (photo courtesy Ed Brown)

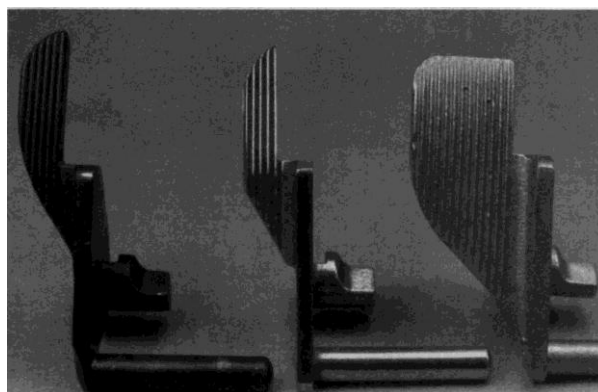
Installing a new safety

You've been shooting your newly-rounded 1911, but the safety just isn't large enough. You want to fit a new one. Before buying one, try fellow club members' pistols to see if there is a safety particularly suited to your hand. There are many, and you may have to try quite a few.

Once your new safety arrives, begin the fitting by checking it to the frame. Strip the frame down bare. Check the fit of the safety into the frame. Does the pivot pin slide in easily? If not, de-burr the hole and lightly polish the new safety's pivot pin. Does the safety lug pass through the frame? If not, use your extra narrow pillar file to file the outside of the lug. Once the lug clears, does the safety press home flush to the side of the frame? If the hole in the frame was not sufficiently beveled at the factory, the safety may not go flush. Use an over-sized drill to bevel this hole.



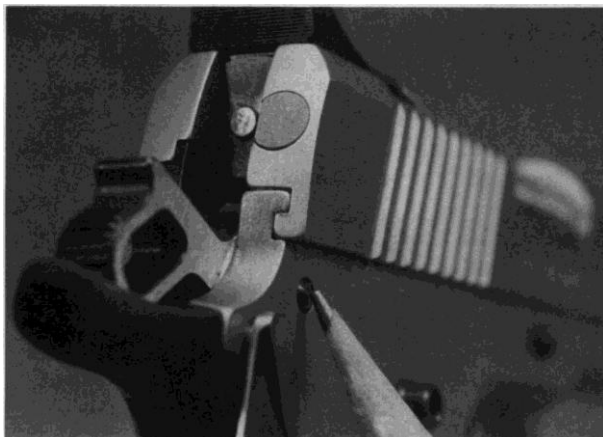
Ed Brown and Les Baer both make ambi safeties.



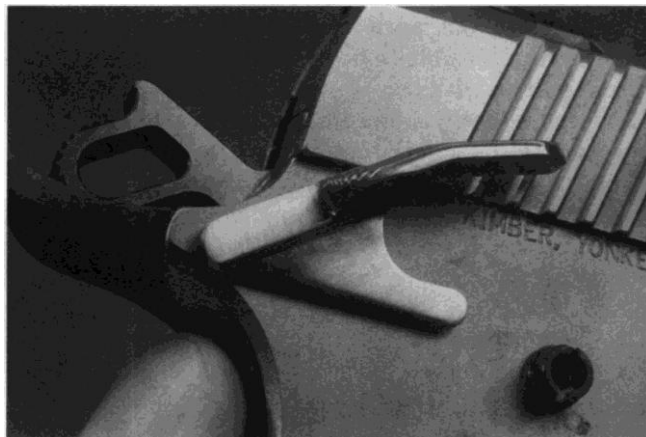
Safeties from mild to wild. The left is a Chip McCormick, the center an Ed Brown, and the right one is a huge safety from Kings. Missing this safety is cause for embarrassment.

You are ready for your final frame checks. Does the safety pivot when it is in the frame? If the slot cut on the safety lug is not deep enough the safety will be unable to pivot. With a flat needle file open this slot until the safety moves freely. Check the extension of the safety to see that it clears both the plunger tube and the grips. Check the safety against the plunger tube, and if there is interference, file the inside of the safety extension. Hold the left grip panel in place, and check the safety to see if it hits the grip. If so, file the grip to clear.

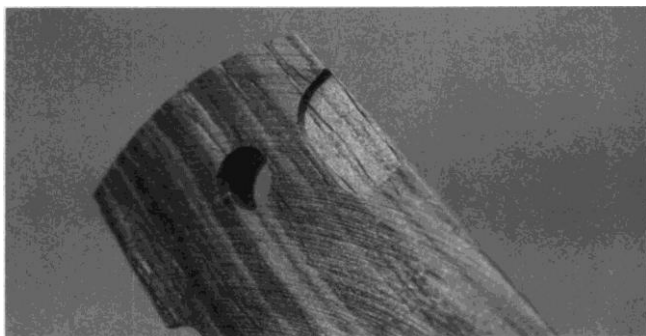
Ambidextrous safeties require additional fitting. Look at the tips of your hammer and sear pivot pins. They are designed to dome slightly above the right hand surface of the frame. You must grind these rounded tips flat until they are flush with the frame. If you do not, the domes will interfere with the right-side safety. Some safeties are kept in place with a tab that sticks under the right-hand grip panel. If your grips are not cut to clear the safety, you must use a carbide cutter in your hand-held grinder to provide clearance. Some safeties use an overly-long hammer pivot pin, with a slot cut into it. The right-hand safety slides into or over this slot, keeping the safety in place. Check the fit of this pin and the right-hand safety.



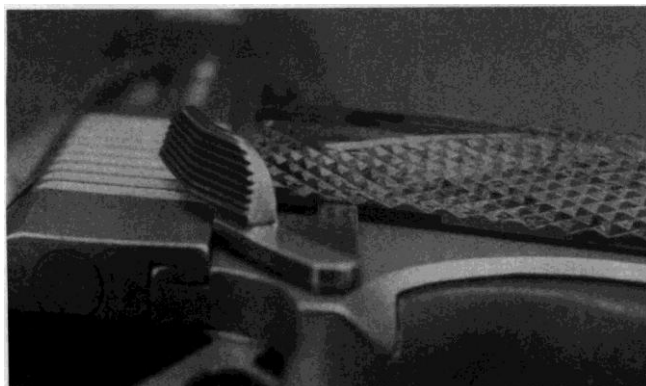
You will have to grind the dome off of the hammer and sear pins. If you don't, the safety will hang up on them.



Here is the right-side ambidextrous thumb safety, in the up, safe, position.



Here is the relief cut, on an Ahrends grip.



Some ambidextrous safeties are held in place by the right-hand grip panel. If the grip is not cut for the safety arm, you must relieve it with a hand-held grinder and carbide tool.

Now you are ready to fit the safety to the sear. Assemble the frame with all of its parts except the grips, grip safety, and thumb safety spring and plunger. Cock the hammer. Slide the new safety into place as far as it will go and look at the sear through the back of the frame. You will see the safety lug striking the side of the sear. Pull the safety out, and compare the new safety lug against the old safety. Look at the small flat filed on the old safety lug. The tip of the hooked part of the new safety lug must be filed at this angle until it will just barely slide behind the sear. As you get close, use a candle to smoke the safety lug and see exactly where it is hitting.

The last fitting is quite delicate. If you have to force the safety up into engagement, the fit is too tight. Look for the marks left behind on the safety lug by the sear, and stone them off. Re-install and press the safety into engagement again.

Once the safety presses into place without marring the safety lug, perform the safety check procedure from Chapter 4. If it passes the test you are done.

What if you went too far, and when you checked engagement you heard that little tink? You filed too much. It is possible to peen the safety lug, and have the gap filled with the upset metal. Clamp the safety in a padded vise, safety lug up, and with your hammer strike the safety lug at its engagement point. Install the safety and check engagement.

If this is not enough to remove the tink, either you must get the safety lug welded or you must buy a new safety. You're faced with an expensive choice—reason enough to go slowly when filing and stoning the safety lug.

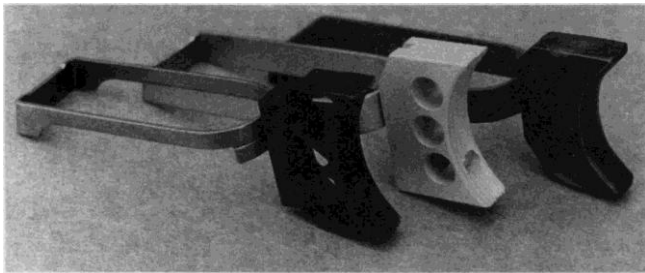
Installing a new trigger

Old-style triggers suffered from two faults: They were of all-steel construction, and they had no overtravel screw.

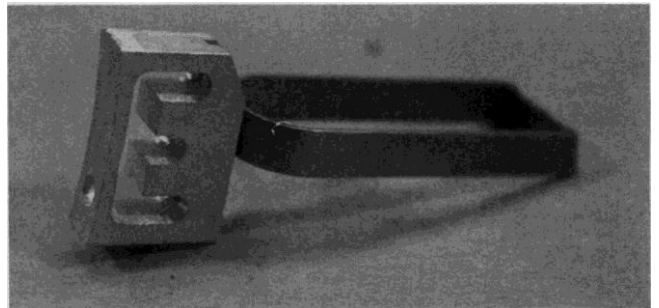
The all-steel construction made the trigger heavy. A heavy trigger, bouncing back and forth in its slot, will strike the sear. If you lighten the trigger pull on an all-steel trigger too much, the sear will not be able to take this hit without being partially or completely dislodged from the hammer hooks. The hammer will fall to half-cock.

Without an overtravel screw, old-style triggers had no provision for stopping their rearward travel. When the trigger had fulfilled its job of pushing the sear out of the hammer hooks it kept moving back. That added movement, called overtravel, can disturb your aim.

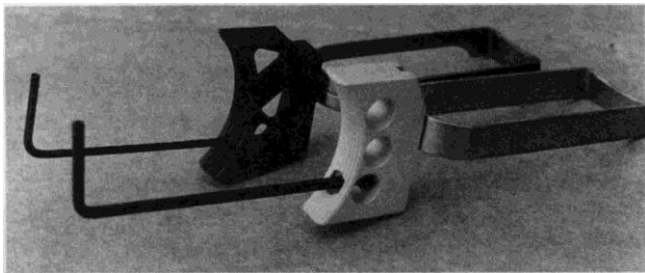
To solve both of these problems install a plastic or aluminum trigger with an overtravel screw. A lighter trigger strikes with less force, decreasing the wear and tear on the sear/hammer hook fit. The lighter weight will also increase the life of your trigger job. The adjustment screw allows you to remove most, but not all, of the overtravel.



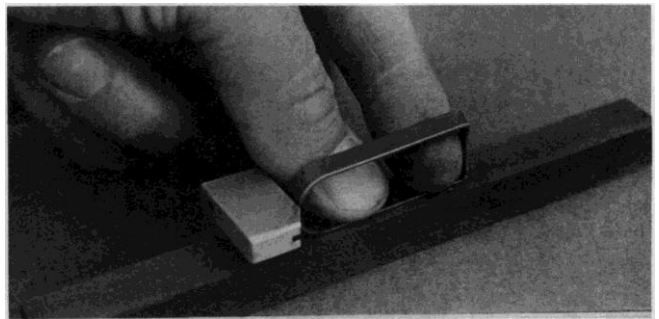
Left to right, Chip McCormick, Videki and an old steel trigger. The CMC and Videki triggers together are lighter than the steel one.



This is a lightweight trigger from EGW that is also longer. It is meant for shooters with large hands.



A replacement trigger should have an overtravel adjustment screw.



If the trigger will not ride smoothly in the slot, stone the sides and high spots.

Strip and clean the frame. Check the fit of the trigger bow in the frame by installing it backwards. If the bow binds, file the high spots until it slides into place. De-burr the edges of the trigger bow. Slide the trigger into the frame in the normal manner, and look into the slot to see if there is any daylight appearing around the trigger body. Pull the trigger out and use a candle to smoke the trigger body on its top and bottom surfaces. Press the trigger into place, pull it out, and file where the soot has been disturbed.

Once you get close, you will be able to force the trigger fully into the slot. Go slowly from here, smoking and filing in small increments. The goal is a trigger that does not have up and down play in the frame, but will fall freely out of the frame when you turn it upside-down.

Install the overtravel screw in the trigger body, then reassemble the frame. Cock the hammer and hold it back with your thumb. Press the trigger and hold it back, too. Now ease the hammer down. The first step in correctly adjusting your overtravel screw will stop the hammer at the half-cock notch. If the hammer goes all the way forward, turn the overtravel screw into the trigger a full turn. Cock the hammer and repeat until the hammer stops at the notch.

Cock the hammer again, and turn the overtravel screw out of the trigger a half turn. Try lowering the hammer. Adjust the overtravel screw in and out until you can feel the hammer, on release, just brushing the tip of the sear. At this point turn the overtravel screw another quarter turn out of the trigger. You must not feel the sear brushing the hammer. To finish, disassemble, and use Loctite to secure the overtravel screw.

Installing a new front sight

The traditional method of securing a front sight is to stake it. The sight tenon goes through the slide, and the foot of the tenon is peened to fill the slot, wedging the sight into place.

To install a new sight, first remove the old one. The quick and dirty way is to clamp the old sight in your vise and rotate the slide, twisting the old sight until it breaks off. Use a drift punch to drive the stub of the tenon out of the slide. If the thought of a twisted wreck of a sight lying on your bench troubles you, or you want to practice filing, you can file the old sight down to nothing and then drive out the stub.

In either case, once the sight is out prepare the top of the slide by filing a flat around the tenon slot. The bottom of the sight blade will bear against this flat. On the inside of the slide, use a carbide cutter or small stone in a hand-held grinder to open up the edges of the slot. This gives the tenon room to expand, securely locking it in place when you stake it.

Check the tenon for fit in the slot. You should be able to press it into place on the slide. If the tenon will not go into the slot, carefully file only enough to get the sight into place. Degrease the slide and sight. Use Loctite on the tenon and slot, and press the sight into place.

Slide the MMC staking tool into place, and with the brass protector on the sight, tighten the locking screw. If you are installing a night sight, use the U-shaped sight clamp. Do not be bashful in tightening the locking screw. If you do not have the sight firmly pressed into place it will lift when you stake it. Sometime in the future (no doubt at the worst possible moment) such an improperly-staked front sight will fly off the slide. As you tighten the screw, check the front sight to make sure it stays straight up and down, and is not tilted by the staking tool itself.

If you're looking at your MMC instructions as you install your sight, you'll see my procedure differs at this point. Experience has taught me to grease the staking wedge and drive it completely through the MMC staking tool, until it drops free on the inside of the slide. Doing so fully stakes the sight, and makes it easier to remove the staking tool from the slide when you are done.

Remove the staking tool, wipe the excess Loctite off, and check the sight for straightness. If you paid proper attention to fitting the tenon and clamping the sight straight, you'll be pleased with your job. If you find that your new sight is tilted or crooked, however, use flat brass protectors in your vise, clamp the sight, and force it straight.

Take your bushing, and see if it will still fit the slide. If it does not, the excess tenon staked in the slide will have to be filed or ground down. Remove just enough to allow the bushing to go back in place without binding.

Installing a dovetail front sight

The Novak front dovetail sight is very popular, with good reason. You can adjust windage using both the front and rear sights. You can easily change to a sight of a differing height. You can install night sights or a 3-dot system without a lot of fuss.

But you have to have the dovetail. And if your slide doesn't have one, then you also have to have a mill.

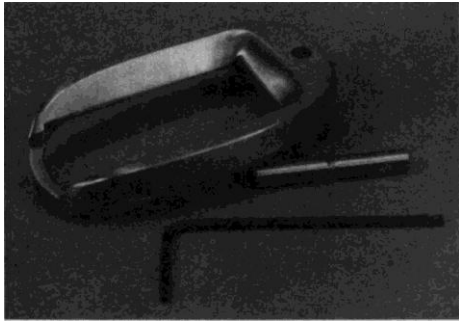
Strip the slide and remove the old front sight. Level and clamp the slide in the mill vise. For the Novak, install a .330-inch X 65 dovetail cutter in your mill. If you are installing another brand, be sure and read the dimensions the manufacturer lists for its sight. Different manufacturers' sights require different size dovetails.

Bring the cutter down almost in contact with the slide, and line up the tip of the cutter edge with the front edge of the slide. Move the cutter back from the muzzle .175 inches. Bring the cutter down just enough to contact the slide. This establishes your vertical zero. Move the cutter to the side of the slide, and lower the cutter .075 inches. Slowly pass the cutter through the slide, using liberal amounts of cutting lubricant.

Remove the slide, de-burr the slot, and fit the new sight. If your slide already has a dovetail, then fitting the new sight is a matter of filing the edges of its dovetail foot until you can press the sight a third of the way into the slot by hand. Drift it the rest of the way with a brass drift. Range test to determine if it is centered on the slide, and to correct its height.

Magazine funnels

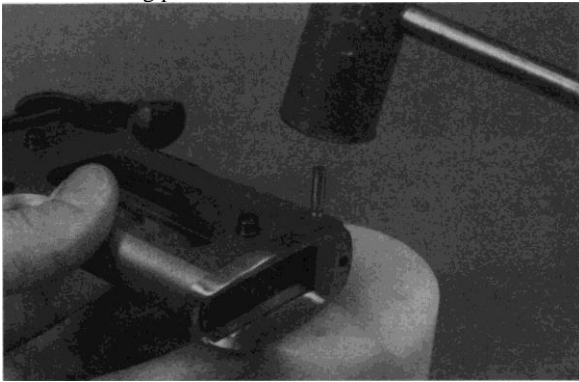
Not all magazine funnels require silver-solder attachment. The Barrett funnel, from Clark Custom, is a painless bolt-on unit. With an unloaded 1911, lower the hammer. Drift out the mainspring retaining pin. Slide the Barrett funnel over the bottom of the frame. Take the longer retaining pin included with the funnel and press it through the holes in the funnel and frame. Use the included alien wrench to tighten the positioning screws. Dab some paint or fingernail polish on the screws to keep them tight.



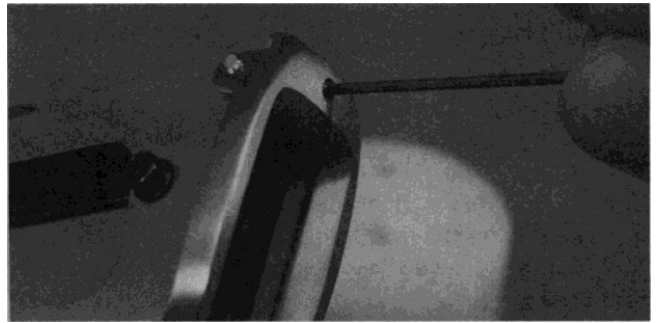
Here is the Barrett funnel, with adjustment alien wrench and replacement retaining pin.



Slide the Barrett funnel onto the frame.



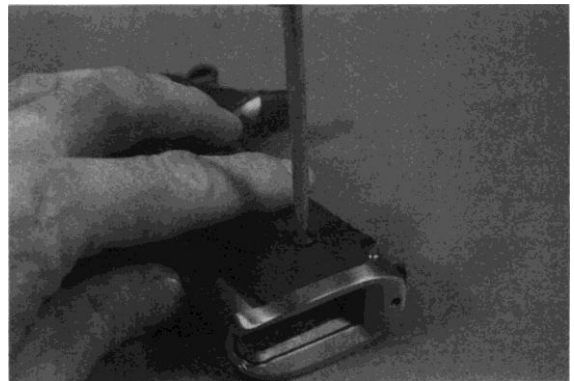
Press the replacement retaining pin in place.



Tighten the rear screw to pivot the funnel tight against the bottom of the frame.



Tighten the front screw to hold the funnel in place.



With the Barrett magazine funnel secured, put your grips back on.



The S & A magazine funnel replaces the mainspring housing.

Get a grip

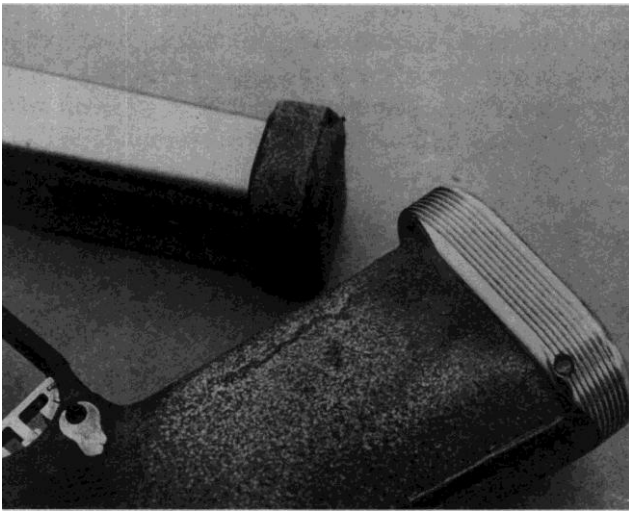
Sometimes the grip or frame of your pistol, 1911 or other, is just too slippery. Traditional improvements have included stippling or checkering (see Chapter 19). A less traditional choice comes from California. (Now there's a surprise!) It's skateboard tape.

For those who have never ridden a skateboard, the tape is a tough, adhesive-backed cloth with a very aggressive abrasive on the top surface. It's the same kind of tape you can use for a non-skid stairstep, but while the stairstep stuff comes only in basic black, the California tape seems to be available only in various neon colors.

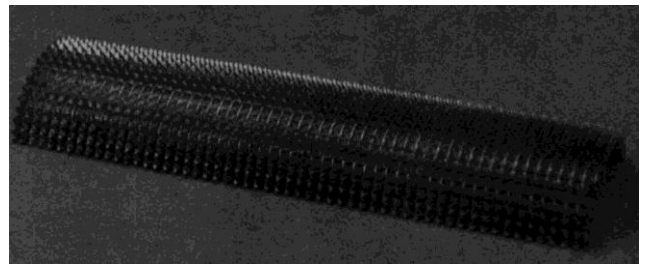
Before I completely turn you off from this approach, let me assure you that it works very well. You will not be some sort of pariah at the range if you show up with a pistol festooned with this tape. Nonetheless, if you decide you just can't stand the stuff, soak your frame overnight in mineral spirits and the tape will give up the ghost. It will not come off if briefly exposed to cleaning solvents.

Competitive shooters who favor high-capacity frames without grips use large swatches of the tape. If you want to try some, take an old pair of smooth grips and attach pieces of the tape to them. Start with a narrow strip of the tape on the front strap. Your preliminary testing has begun.

If you find that you like the tape, you have two approaches to attaching it to your pistols. One is to use narrow tape, and cover the frame piece by piece until you have blanketed the gripping area. The other way is to get a larger sheet and trim it to the contours of the frame. Install it as a single piece.



Skateboard tape will provide a non-slip hold, if you can stand its non-traditional looks.



This is a pre-checkered panel from EGW. You can epoxy or solder it onto your frame, or you can even cut the frame out and solder or weld this in the gap. That is very advanced pistolsmithing, and a subject of future volumes.

One of our local shooters is so fond of skateboard tape in hot pink that he has all his competitive handguns, rifles, shotguns and their magazines treated to patches and swatches of the stuff. He has no problem picking his rifle out of a rack of otherwise identical black rifles.

If tape—black, green or pink—is just not your thing, you can use a pre-checkered panel on your 1911. Wilson and EGW both make panels that will fit right on your frame. The Wilson panel has extension tabs that fit under your grips. Take the grips off, fit the panel on the front of the frame and bend the tabs back to hold it in place. Tighten the grips down to secure the panel.

To secure the EGW, and for a better job with the Wilson, get Brownells Acra-Glas Gel. This two-part epoxy mixes up into the consistency of soft butter, which makes it easy to use. It will not run and end up someplace other than where you intended it to be. Remove the grips. Degrease the frame and checkered panel. Mix the epoxy, and spread an even coat of it on the frame. Press the panel in place, and clean off any excess that oozes out. Use large rubber bands to clamp the panel and keep it from shifting. Check it in a few minutes to make sure it hasn't moved on you. Let the Acra-Glas cure overnight. Clean off the excess hardened epoxy with a file or knife edge. Put your grips back on, and you are done.

If you want to make the bond even more secure, you can soft-solder the panel onto your frame. Although both epoxy and soft-solder will dissolve if sent through the bluing tanks, the soft-solder attached panel is less likely to quit if it is dropped or subjected to extreme cold.

Chapter 19 - Advanced Pistolsmithing The 1911

Going beyond basics on the 1911 requires more tools, more practice, and greater study of how the parts of your pistol operate. The rewards are great. You'll gain not just a better understanding of your pistol, but a pistol that operates just about perfectly and fits your hand beautifully.

You'll be able to shoot better than ever before.

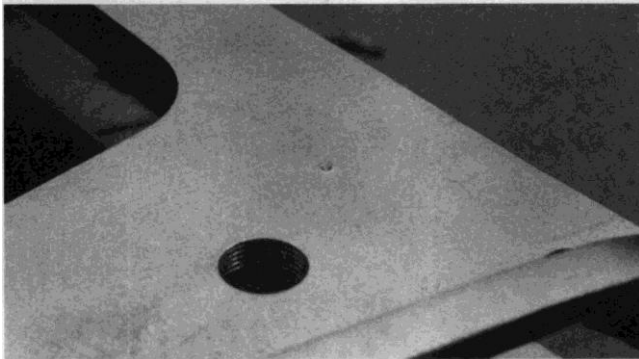
Before diving in, take a step back and consider your options. There are three paths to a custom or super-custom 1911. If you want to work on a pistol you already own, you can do everything yourself. With your own pistol you can also shop out some, or all, of the work. If you want to create your own custom design, you can buy separate match grade components and fit them yourself.



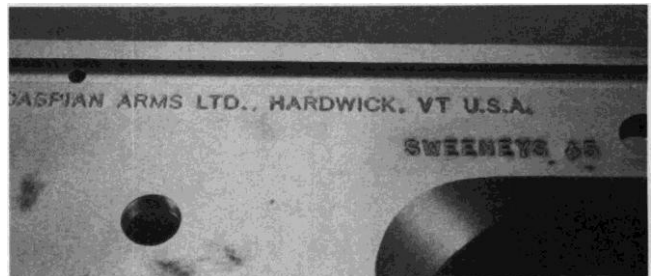
All Caspian frames and slides include an inspection tag showing who approved it, and what its score on the hardness test was. The frame came in at Rockwell C-25, and the slide at RC-41. Both are normal and correct. You may find that softer slides are cheaper, but they won't last as long under hard use.



The Caspian Race-Ready frame kit includes everything but springs and grips. Just put it together.



The little dimple on this frame is where Caspian tested it for hardness. It passed, or it wouldn't be shipped.



When you order a Caspian frame, Race-Ready or otherwise, you can get a custom serial number. It must contain at least one number, and it has to fit on the frame.

Buying and fitting your own parts was not always possible. In 1985 while still a sub-contractor to other manufacturers, Caspian Arms first explored the marketing of custom slides and frames directly to the consumer. Today, if you have a 1911 with a dead slide you can get a replacement from Caspian in any length, in blue or stainless, and with the dovetails already cut for your sights. You can order a frame to replace an over-experimented one, a barrel, and other components. If you want just the basics to build your own pistol order a frame and slide.

Or go whole hog.

Caspian offers a Race-Ready kit. The kit contains all the parts needed to assemble your 1911 except the grips, thumb safety and the springs. The fitting and assembly are up to you, but with Caspian's close tolerance machining, the work goes easily.

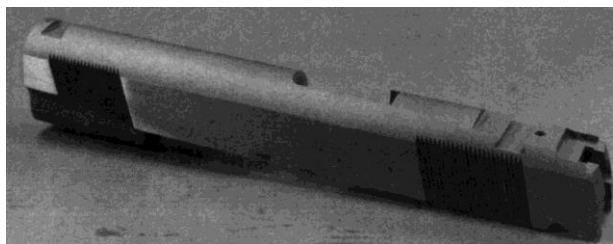
Where one goes, others follow. Chip McCormick was the first to offer hammers and sears that were held to such close tolerances that they did not require any stoning. Chip expanded his line of internal parts to include the whole pistol in the early 1990's. Today you can order just a slide and some internals to upgrade your present pistol, or you can order a complete basket of goodies to assemble a new pistol.



Les Baer offers parts, frames, slides and pistols. You can mix and match, or simply order a complete package.



Ready for assembly, this Les Baer slide-frame kit has all the hard work already done to it.



A match slide from Les Baer. This has it all. Front grasping grooves, a Novak front and Bo-Mar rear dovetail cuts, lowered ejection port and already fitted to a frame.



The Les Baer frame has the curve of the front strap and trigger guard cut higher. This lets you get your hand higher on the frame, gaining better control of the pistol.

Les Baer offers a very attractive deal on a slide and frame package. I received a frame already cut for a high-ride beavertail, with front strap checkering at 30 lines to the inch. The slide, dovetailed for a Novak front and a Bo-Mar rear, had extra cocking serrations up front. The fit of the slide to the frame was excellent—smooth and tight.



The STI Short Block has all the hard work done. The slide, frame and barrel have all been fitted. You need to put sights and internals in it. A great deal, and a great pistol.



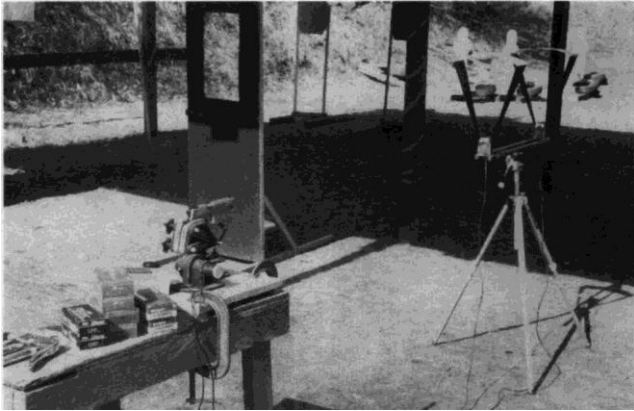
This Wilson slide-frame pair are already fitted to a smooth sliding fit. (photo courtesy Wilson Combat)

The best deal in a component 1911 is the STI "Short Block" kit. The STI is not a standard 1911 with a magazine capacity of eight rounds of .45 ACP but a high-capacity frame with a double-stacked magazine holding 15. The lower part of the frame is a durable polymer. The big advantage to the Short Block is that STI does the frame to slide fitting, installs a match barrel, and ships the kit with a recoil spring installed. All you have to do is install the frame parts behind the trigger, and put sights on the slide. Even if you were extremely particular fitting the parts, you would be ready to go to the range after an evening's work.

If you do not want to build a pistol from the ground up, but want to breathe some life into your tired 1911 with a new slide, then Scott Hunter of Speed Master can make a slide to your specifications.

Purchasing match grade component parts or kits is expensive. Buying just a slide, barrel and frame can easily cost you as much as a whole pistol out of the box. But the out-of-the-box pistol will not be as tightly fitted or machined to the close tolerances of the match components.

By customizing your own 1911 yourself, however, you can make your pistol fit almost as tight and its operation just as smooth as a match kit pistol, at a fraction of the cost. Even if you end up sending some of the work to a pro, a reasonable fall-back option for difficult jobs requiring special tools, you'll still save money (and learn more) doing your own work.



The Kimber in the Ransom rest, being checked for velocity and accuracy at the same time.



Here is the Kimber, with the McCormick grip safety.

Fitting the slide to the frame

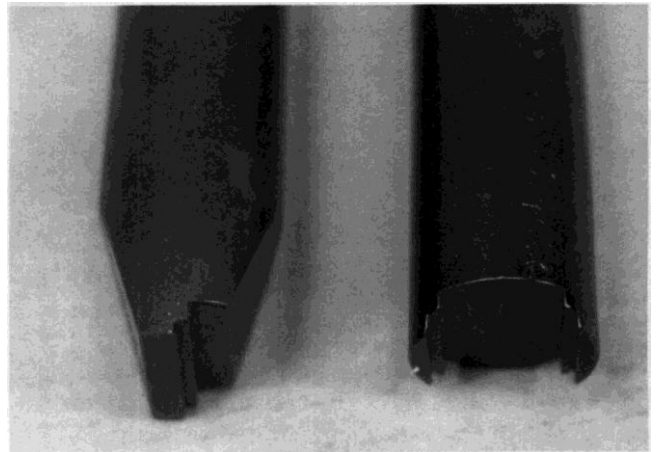
In order for manufacturers to make parts they must leave a gap where any two parts are to be fitted. In order to assemble two parts made at any time over what can be years of production, this gap must be larger still. The measurements that allow assembly are called "tolerances." The larger the tolerances, the looser the fit. While a loose fit between the slide and frame can be beneficial to reliable function, it is not necessary. It is almost always detrimental to accuracy.

To improve accuracy, you should remove any play between slide and frame. Do you have to? No. You can correctly fit a match barrel to your loose slide/frame fit, and have a wonderfully accurate pistol. But it will never shoot up to its full potential.

You can remove the slide/frame play after you have fit a match barrel or bushing to your pistol, but the barrel will have to be re-fitted. Better to work on your slide and frame, and then buy and fit your barrel.



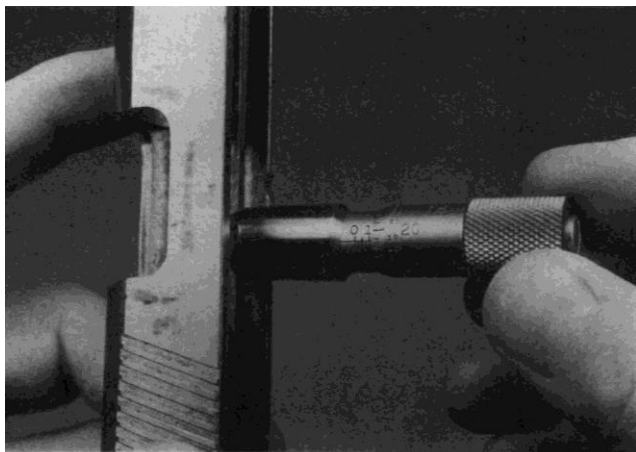
Here are the forming rails and the holding fixture. With the holding fixture, you canpeen the rails without a vise or vise holding plates.



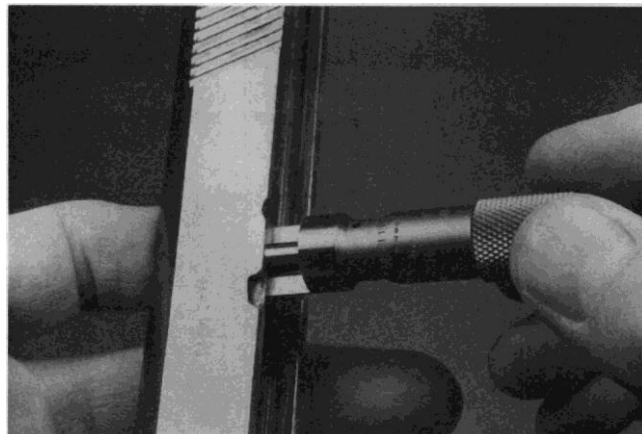
The business end of frame rail swaging bars. The single on the left, or the double on the right, press the rails down to your forming bars.

The simple method of fitting the slide and frame is to peen or swage the rails of the frame. Peening and swaging differ in how much metal is moved when you strike with your hammer. You will need your ball peen hammer, dial calipers, a rail forming bar or steel shim of the correct thickness, and some means of holding the frame without crushing it. For swaging you will need a swaging bar. For fitting the peened or swaged rails you need stones, your pillar file, lapping compound and either a plastic faced mallet or a slide lapping tool.

Check the face of your ball peen hammer. You must polish out any marks on it or they will be transferred to the rails when you strike them.



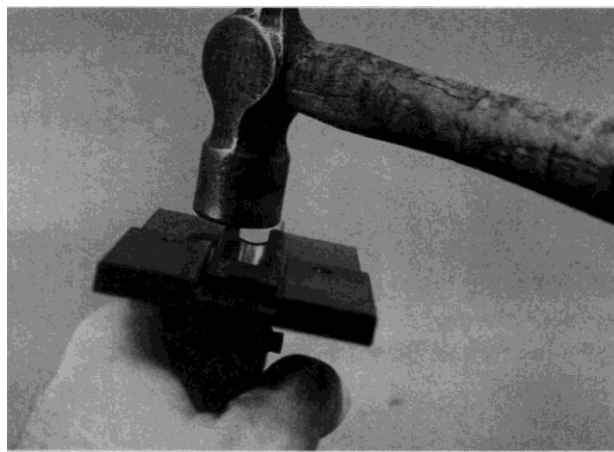
This Starrett rail micrometer is very handy for measuring the slide rails, to choose a set of forming bars. This is an over-sized slide and the rail measures .119 inches. On some frames you may not need forming rails, just lap the slide to the frame.



Measure the rails at several points, on both sides. Take the average and add .002 inches for your forming rail.



Clamp the selected bars in the holding plate, and slide them on the frame.



Holding the frame, peen the front rails.

Detail strip the frame and slide. Measure the height of the slide rail—that portion of the slide riding within the frame's machined-in slots. Select a rail forming bar or shim that is .002-inches thicker than the slide rail measurement and place it within the slots.

To keep the bars in place before peening, I recommend Brownells dual forming bar holder. The holder will keep both forming bars in place while you are peening the rails. To avoid cutting yourself reinstall the grip safety and mainspring housing in the frame. Place the appropriate bars in the bar holder, the bars and holder in the frame rails and hold the entire assemblage in your hand.

Beginning with the rails forward of the magazine opening, use your polished ball peen hammer to strike the top of the frame, in front of the magazine opening. Do not strike the rails at the magazine opening. You may crack the frame or peen the rails into the opening, binding the magazine after assembly.

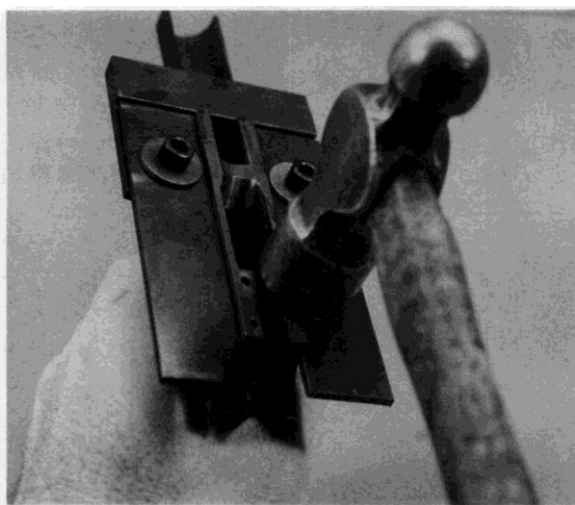
Because the frame is positioned only in your hand, the simple method of fitting slide to frame requires greater striking force than is needed with a frame-holding fixture. The fixture allows you to lock the frame into your vise. With both hands free you can use the rail forming bars one at a time. For extra rigidity and insurance against slippage while you are peening, place a hardwood block under the base of the frame.

Once the rails have been peened down on the front corners, remove the forming bars and check the fit of the slide. You may find that it binds. Sometimes when the rails are being peened down they also get peened slightly out. Binding indicates you have widened the rails more than the clearance slot in the slide. The lazy way is to lap the fit with grinding compound. Don't take the easy way out. You want to end up with a free-running fit between the slide and frame, without loosening the peened fit you just worked so hard to obtain. Put Dykem on the rails, and try to install the slide. You will see the Dykem rubbed off on the high spots. Use a stone to dress down those high spots on the outside of the rails. Once the slide will go on the frame, Dykem the rails again and work the slide back and forth. Locate the high spots and stone again.

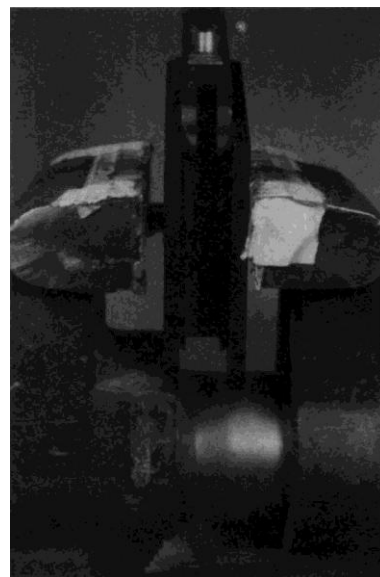
An occasional problem you may run into when checking the slide fit is interference with the recoil spring tunnel, or dust cover. The lowered slide may bind against it. Dykem the top of the dust cover and install the slide. If the Dykem is rubbed off, use a file to remove a few thousandths from the high spot. Repeat until the slide does not touch the dust cover.

Once the front rails are lowered and the slide moves smoothly, peen the rails behind the magazine opening. Then complete the rail fitting.

To swage, you must have a frame holding fixture and a swaging bar. The working end of the bar is shaped to press down the rail all at once, not just in the smaller area of the hammer blow. Place the forming bar in the rail slot, and the swage on top of the rail. Strike gently at first, gradually increasing the force of your blows until you feel the rail move. To see if the rail has been fully swaged check the forming bar for play. Swage until you can no longer feel any play.



Once you have fit the front rails to the slide, peen and fit the rear rails.



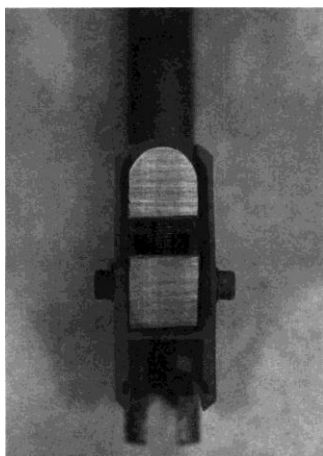
The frame holding plates (this set is from Powers) should rest against the vise or a wooden block, to give support to your hammering.



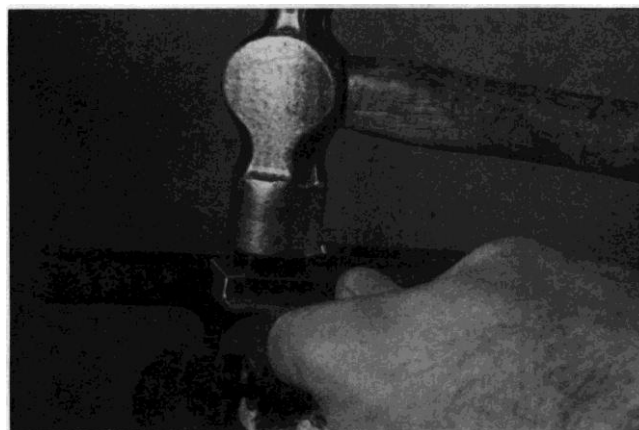
The Weigand frame holding fixture, for peening or swaging the frame rails. Made of aluminum, it will securely hold the frame while you fit the rails.



Strike the swaging bar to move the frame rails down to the forming bars.



The Powers frame holding plates include a magazine filler bar. This prevents the vise and plates from collapsing the magazine tunnel.



With only forming rails and a ball peen hammer, you can tighten the slide-frame fit.

Swage the front rails and check the slide for fit. If tight, stone the high spots as above. Swage the rear rails. If you feel the need for the extra speed, the swage is available in a double-sided face, so you can swage both the left and right rails in one step.

Peening and swaging remove the up-and-down play in the fit of your slide. You still may feel side-to-side play. If so, you need to squeeze the slide. You will need a slide squeezing fixture. Measure the inside width of the slide and place the slide in the squeezing fixture in your vise.

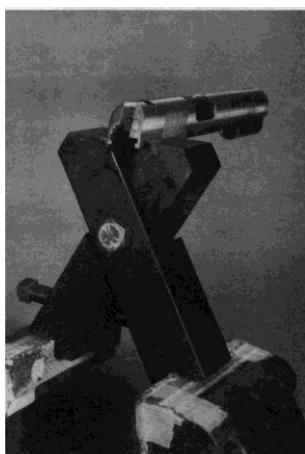
Squeeze the slide until the inside of the slot is $.020$ -inches smaller than your initial measurement. Let the slide sit in the vise this way for 30 seconds, then remove the slide and check the fit. The slide will now require force to move along the frame, but it should still move. If you overdo the squeezing and the slide will not move, you will have to reverse the fixture to expand the slide. This is hard on the slide, and should be avoided. On the other hand, if the $.020$ -inches squeeze didn't remove all of the side-to-side play, repeat the slide squeezing process, but this time reduce the slide slot width by a total of $.025$ -inches.



When squeezing the slide, measure the slide width before, during and after compression.



Squeeze the slide to remove side to side play.

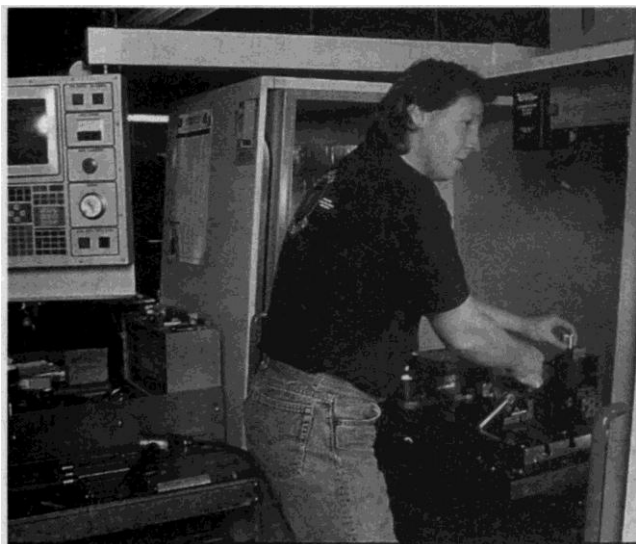


The slide has to be squeezed at the rear as well as the front part of the frame rails.

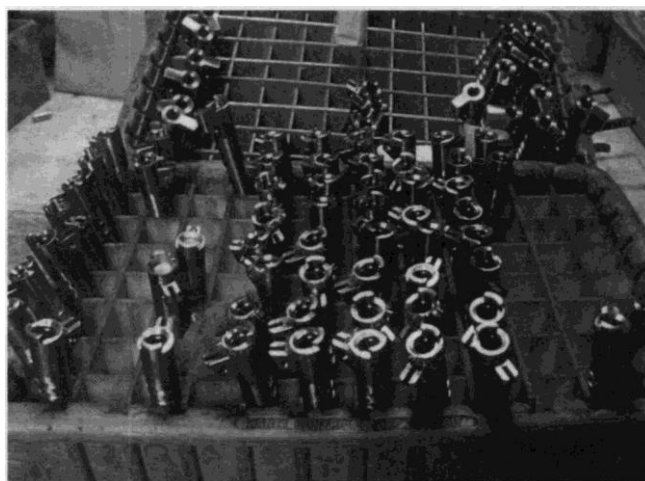


After fitting the slide and frame you have to lap them to a smooth finish. This tool from Marvel and Brownells lets you push and pull the slide back and forth. You don't have to hit the slide with a plastic mallet.

With your peened and squeezed pistol fitting so tightly that you can barely move the slide, now is the time for lapping compound. Place a thin layer of 600 grit compound along the full length of the rails. Move the slide back and forth a dozen times, either rapping it with the plastic faced mallet or inserting the lapping tool and pushing and pulling the slide. Scrub the lapping compound out, lube the rails and check the fit. If the slide still does not move smoothly, repeat. Your goal is for the fit to pass the gravity test. When simply tilting your cleaned and lubed slide and frame makes the slide travel fully backward and forward you are done.



You can't make barrels with a file and a drill press. To do it right takes expensive equipment. Here Irv loads steel into an automated computer-controlled machining center. (photo courtesy Bar-Sto)



When barrel makers make barrels, they make a lot of them. These are Bar-Sto barrels awaiting shipment. (Photo courtesy Bar-Sto)

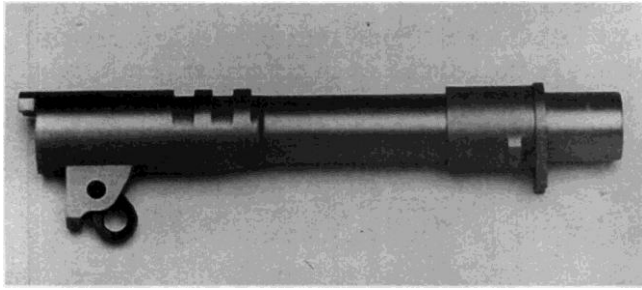
Fitting the match barrel

The heart of the 1911 is the barrel. An accurate and properly fitted barrel will deliver a level of precision to your shooting that might just astound you. Don't waste time or effort on an inaccurate barrel. Likewise, don't bother with one that's been improperly fitted, or cut comers yourself when fitting a new one. An improperly fitted barrel is not only going to be unreliable, but may well damage the slide.

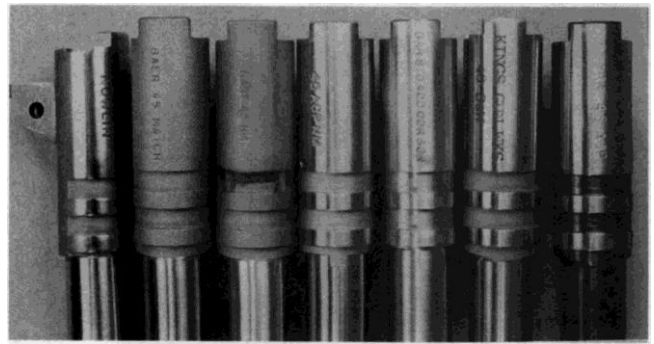
Some would-be poets have labeled the task of properly fitting a 1911 match barrel as existing somewhere in the land between art and alchemy. Naw. You just have to keep track of the details.

Fitting barrels takes patience, skill and a few hand tools. Irv Stone III of Bar-Sto shows how. (photo courtesy Bar-Sto)





This Ed Brown barrel comes with bushing, link and pin. You can buy a drop-in barrel, or a “gunsmith fit” barrel. Quite often the drop-in will shoot so well you won't need the tighter fit of the other, (photo courtesy Ed Brown)



Unlike the old days, there are a number of top-quality match barrels available for the 1911. From right to left: Clark, Kings, Bar-Sto, Olympic, Kart, Les Baer and Nowlin. And this is not an exhaustive selection.

What kind of accuracy should a match barrel deliver? Without any slide/frame tightening and using ammunition the pistol likes, the best you can expect from most factory barrels is three-inch groups at twenty-five yards. I have seen stock 1911's that would shoot three-inch groups with some ammo, and six — or seven-inch groups with other ammo. A match barrel should deliver under two-inches with ammo it likes. With ammo it doesn't like the groups should still be under four. Tightening the slide and frame will improve those numbers. I have a number of pistols, some with Bar-Sto barrels, others with Nowlin, Kart or McCormick barrels, that will deliver one-inch groups or less at 25 yards out of the Ransom Rest.

I did not have to trade off any reliability to get that accuracy. I started with a match barrel, and then properly fitted it to its pistol.

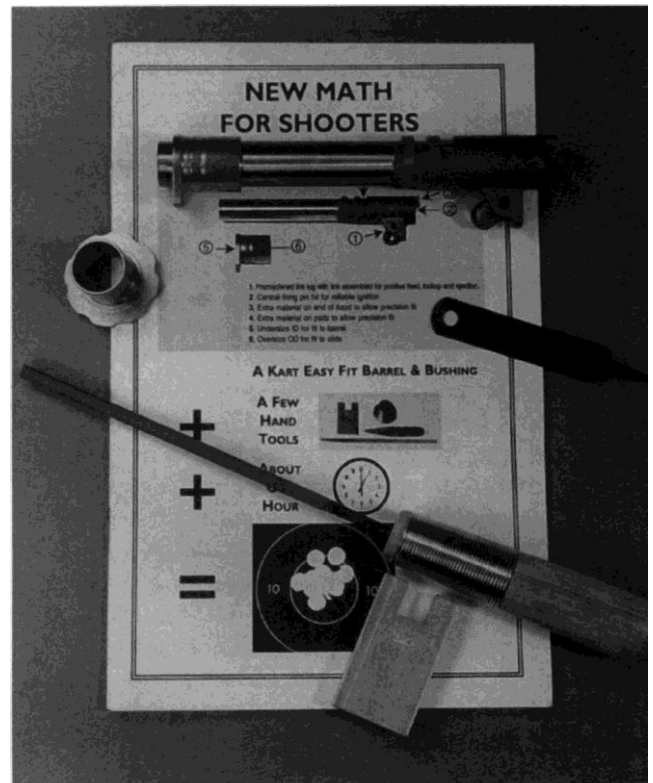
The 1911 barrel locks up in the slide by means of the locking lugs. It is supported in three other locations: the sides of the hood, the bottom lugs, and the bushing. Proper and consistent lockup and support mean consistent accuracy. Match barrels come in two categories, “drop-in” and “gunsmith fit.” Although the drop-in barrel should do just that, not all pistols are identical. Even a “drop-in” barrel may require fitting. The gunsmith fit barrel is oversized in all of its rear dimensions, and you must adjust these to the individual pistol.

I have found Bar-Sto drop-in barrels to be true to name in Colt and Springfield pistols. In many installations over the last few years not one of them has needed any fitting. Chip McCormick's drop-in also slides right into place, without any play or looseness, and without having to do any fitting. From opening the shipping box to the end of fitting takes 15 or 20 minutes.

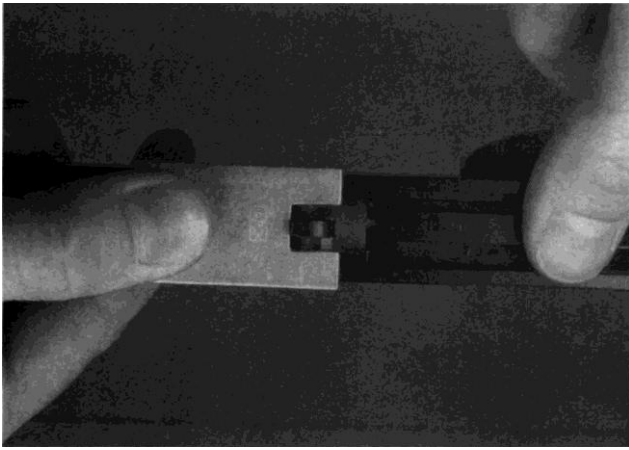
Kart offers a barrel that takes a small amount of fitting. Shipped with instructions and its own fitting tools—including link, pin, bushing, feeler gauge, hood alignment gauge, fitting bushing and upper lug fitting file—the Kart requires about an hour to fit. Nothing in the kit is oversized except the hood length.

To fit a gunsmith-fit match barrel you will need the barrel, a spare bushing that fits the barrel more loosely than the match bushing does (or the Kart fitting bushing), your regular files, a barrel fitting file, a bottom lug cutting tool, a bottom lug file, a hood and locking slot gauges, a .003-inch feeler gauge, and a selection of barrel links.

Strip and clean your slide and frame. If you have a match bushing installed, remove it temporarily. If your barrel has a link installed, remove it, also temporarily.



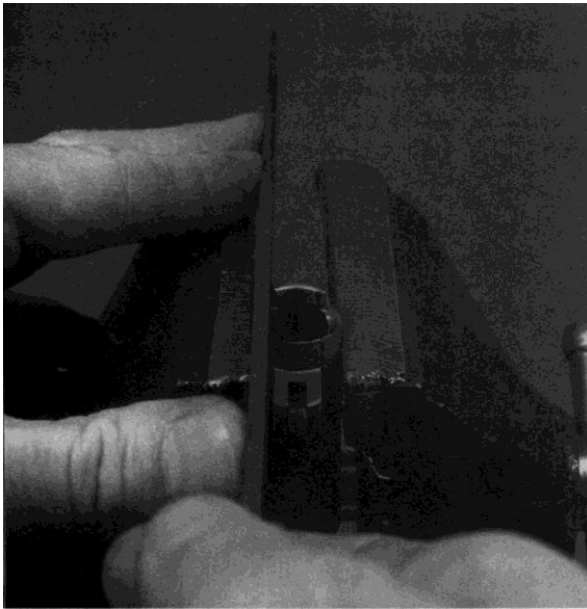
The Kart Easy-fit barrel includes all the tools you will need, for this and future barrel fitting. Considering the cost of a match barrel, the tools are free.



Use the bottom lug alignment gauge to keep the barrel centered and upright.



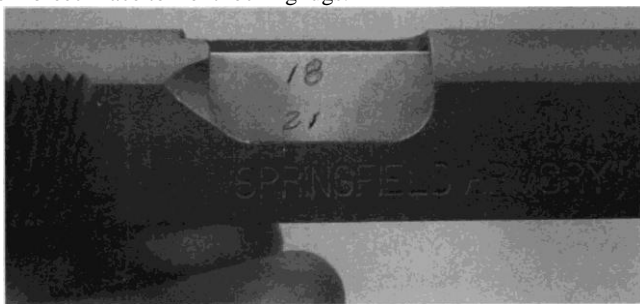
The Kart kit comes with a fitting bushing. This lets you fit the rear of the barrel without worrying about false readings from a tight match bushing up front.



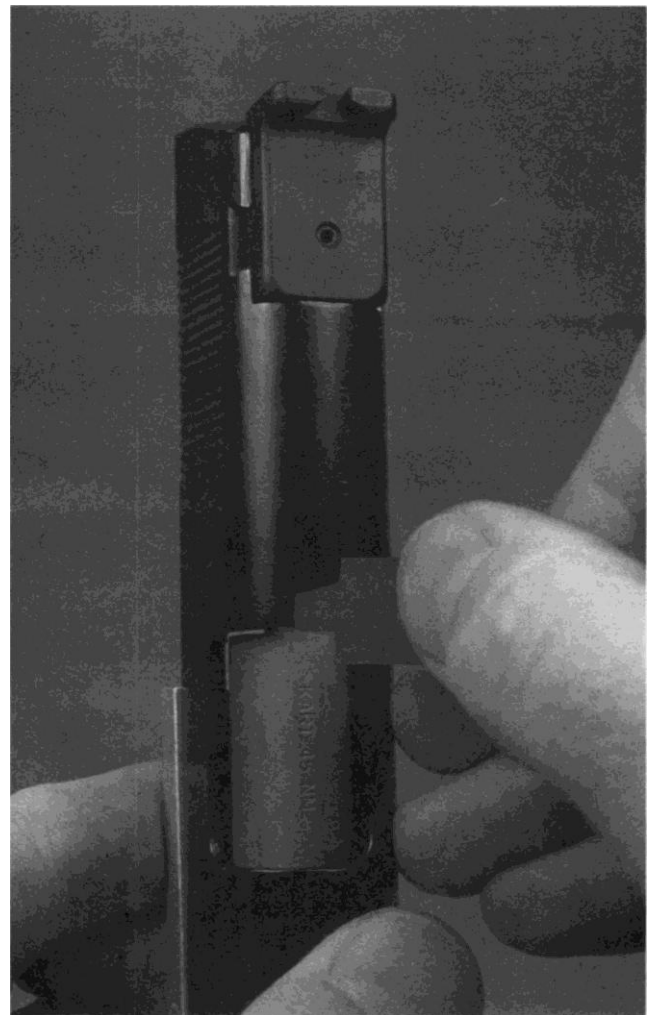
Carefully file the sides of the hood until you have .003-inches of clearance on each side.



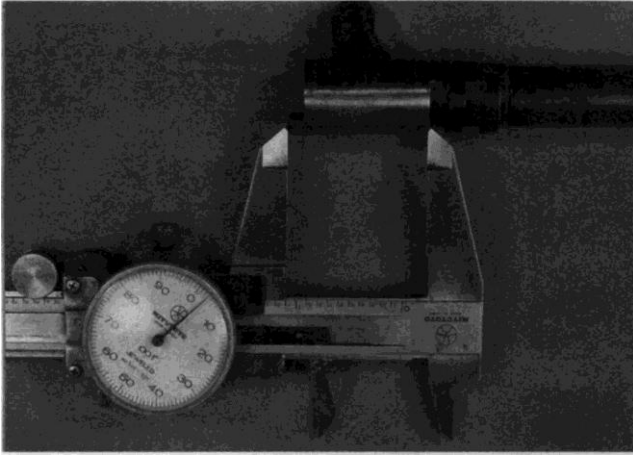
The EGW hood gauge makes a tough task easy: measuring the distance from breech face to front locking lugs.



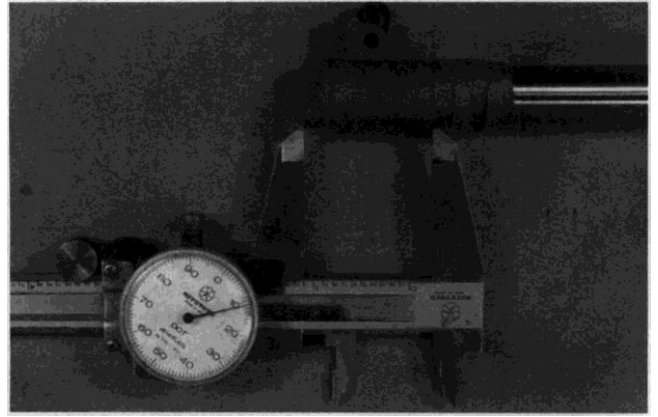
The EGW hood gauge informs us that this Springfield slide measures 1.318 inches from breech face to front locking lug. Now the match barrel hood can be shortened.



Use the feeler gauge to check hood sidewall clearance.



When fitting a barrel you have to measure your hood.



A gunsmith fit barrel will be longer in the hood than the distance from your breech face to your slide's locking lug.



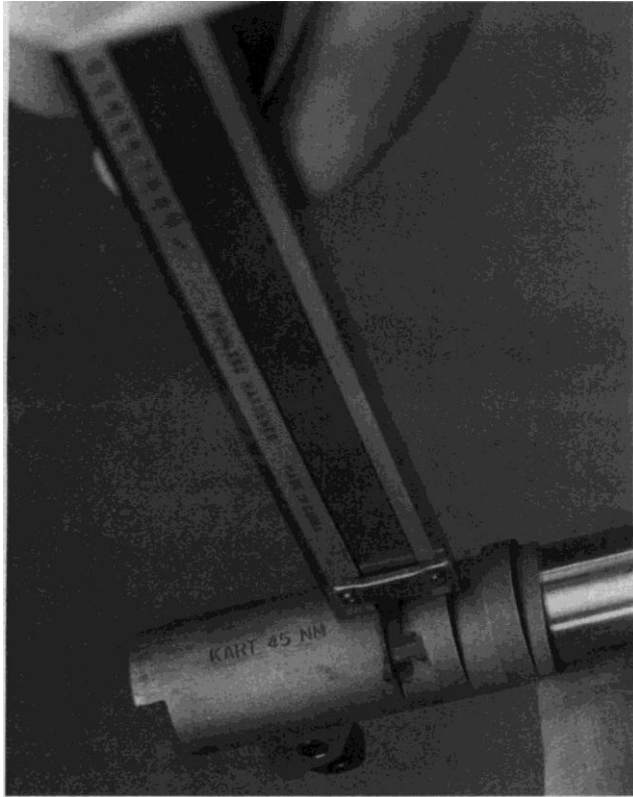
You can also use a marking pen to check locking lug engagement and fitting pad pressure.



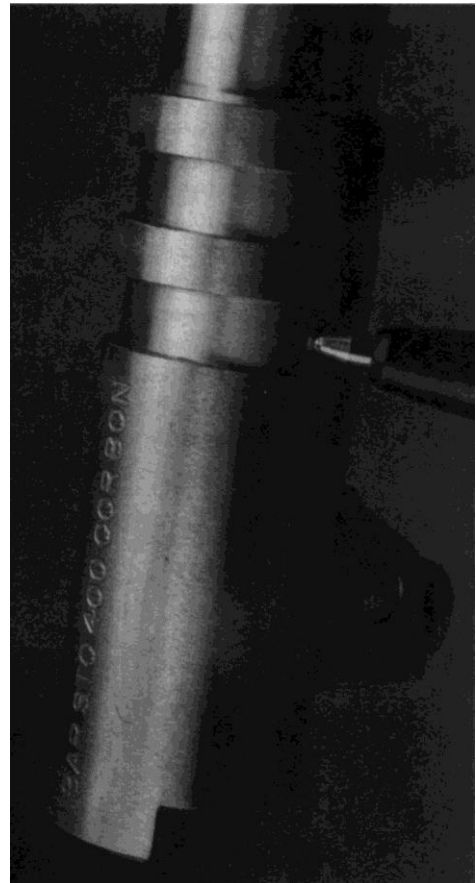
With the locking lugs coated with Dykem, smoked with a candle, or with a little blob of modeling clay in the slot, rap the bottom lugs. You can then measure locking lug engagement.

Take your new match barrel and measure the width of the hood. It will be wider than your breech face opening. Install the barrel and your spare bushing in the slide. Put the hood gauge in the slide, and with a spare bushing in place, slide the barrel back towards the breech face. Hold the slide and barrel up to a light and see which side needs filing. Remove it and file for a few strokes. Repeat on each side of the hood until the barrel will slide back to the breech face. Use your feeler gauge to determine that you have at least .003 inches clearance on each side of the hood, and that the area you have filed is parallel to the breech face sidewalls.

The barrel extension will be too long to lock in the locking slots. Use the EGW hood gauge to determine the length of your slide's locking slot to breech face distance. The easy way to shorten the extension is to chuck the barrel in the lathe. Take light cuts and measure the hood length until it is two or three thousandths more than your hood gauge measurement. Dykem the extension and check the fit. File only the binding areas until the barrel drops into place without pressure. There should be no back and forth movement.



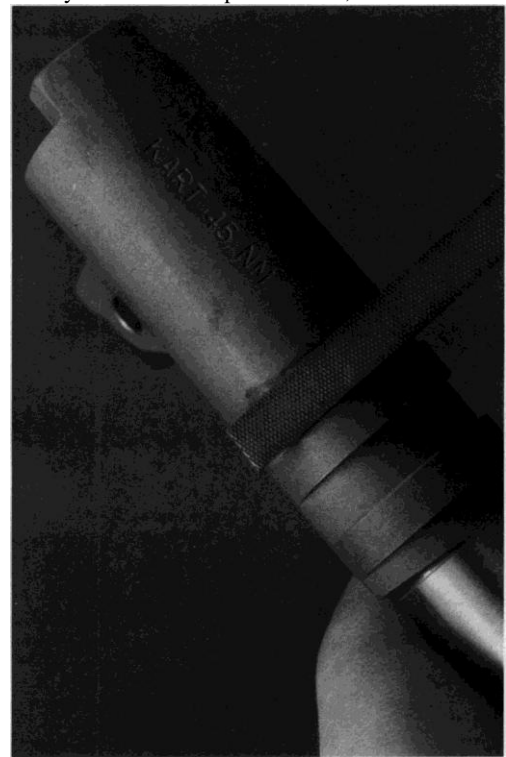
Use a dial caliper to measure locking lug engagement.



On Bar-sto barrels the ends of the rear slot control the upward movement of the barrel. If you need more upward travel, file here.



The Kart barrel uses pads machined in the slot to control upward travel.



The barrel fitting file just fits the locking lug slots.

You must next fit the upper lug engagement. Dykem the barrel locking lugs. In premium barrels upward movement is controlled by the rear slot. Place the barrel in the slide and press it into the lugs. Take a hammer and tap the bottom lugs of the barrel in the direction of the muzzle. Remove the barrel and measure the marks on the Dykem to see how much of the upper lugs are in engagement. You want to have a minimum of .055 inches of lug contact, and more is better.

On a Bar-Sto the ends of the slot stop the barrel's upward movement. On the Kart pads in the slot stop the barrel. If you are below the .055 inch minimum, use a candle to smoke the stop points, and press the barrel back into place in the slide. Remove it and check these points. Filing the stop points allows the barrel to move higher in the slide, increasing upper lug engagement. The barrel fitting file is just narrow enough to fit the slot. File where the smoke is rubbed off. Check the hood fit frequently with the hood gauge and feeler gauges, to make sure you are removing metal evenly.

Check the barrel spring with the match bushing. Install the match bushing and the barrel in the slide, and push the barrel into the locking lugs. The barrel should slide smoothly into place, and stay there. If you can feel the barrel spring back out of locking engagement, it is binding on the bushing skirt. Use 600 grit cloth and polish the top inside of the bushing to relieve this binding.

Install the barrel with its looser bushing or the Kart fitting bushing, and use the locking bar of the lug cutting tool to secure the barrel in place. Use the hood gauge and feeler gauge to make sure the barrel is centered. You need to fit the lower lug engagement.

Slide the assembly onto the frame, and insert the cutter through the slide stop hole. While pressing the slide forward, use the cutter to remove metal from the bottom lug, stopping when the back of the slide is flush with the back of the frame. Strip the parts, remove the barrel positioning rod, and clean the chips out. Dykem the bottom lugs. Replace the slide and barrel on the frame and put the slide stop in place. Push the slide forward until it stops. Pull the slide out of engagement and remove the barrel. Use your round fitting file to remove metal from the bottom lug where the Dykem is rubbed off. Use your feeler gauges to check that your work is even. The bottom lug must sit squarely on the slide stop, and the hood must ride centered in the hood slot. Repeat the process until you can press the slide home without any more force than you need to slide it on the rails. The bottom lugs are now properly fitted for locking.

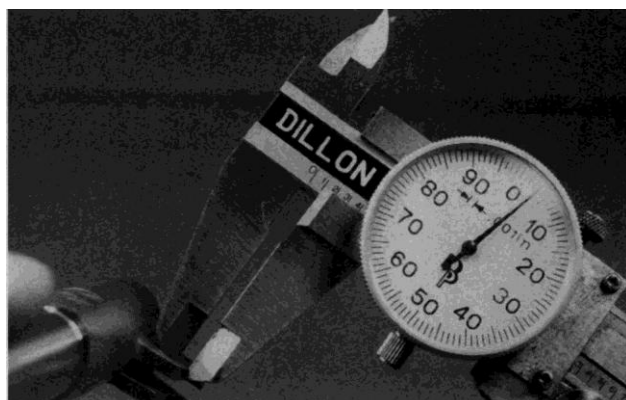
Use your dial calipers to measure the distance from the barrel link hole to the just-filed surface of the bottom lugs. Measure the web between the holes on your link. This measurement cannot be greater than the barrel measurement. If your link is too short you can't install the slide stop. Too long and you won't be able to close the slide. If the link provided does not measure the same or slightly less than the barrel measurement you must select one that does.



The fitting pads on this Kart barrel have been filed to let the barrel ride higher in the slide.



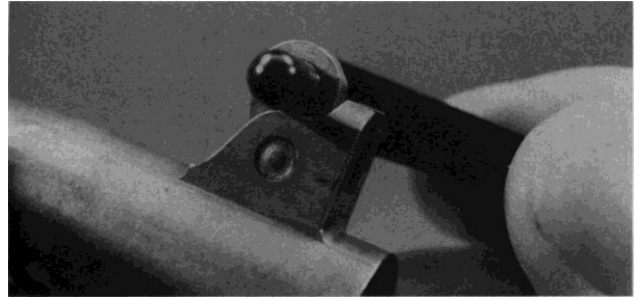
Here is the Kart match bushing included in the kit. With a properly fitted bushing up front and a tight fit in the rear, you will get the full benefit of a match barrels accuracy.



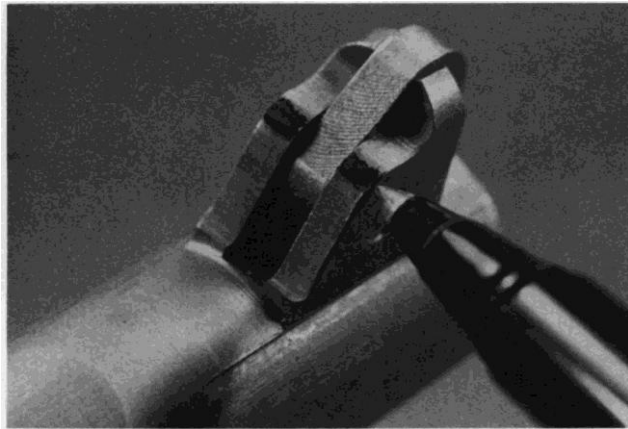
Measure the distance between the link pin hole and the just-fitted lower lug shelf.



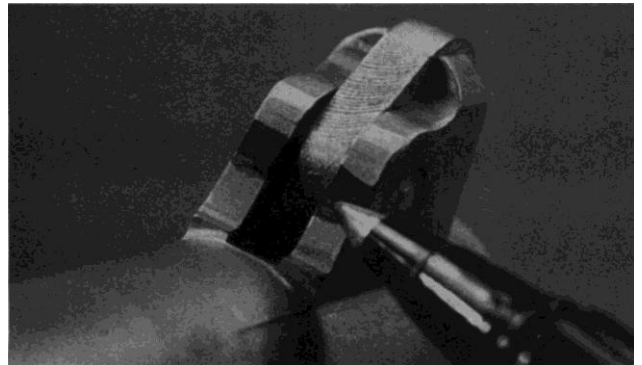
Select a link that is the correct length for your 1911.



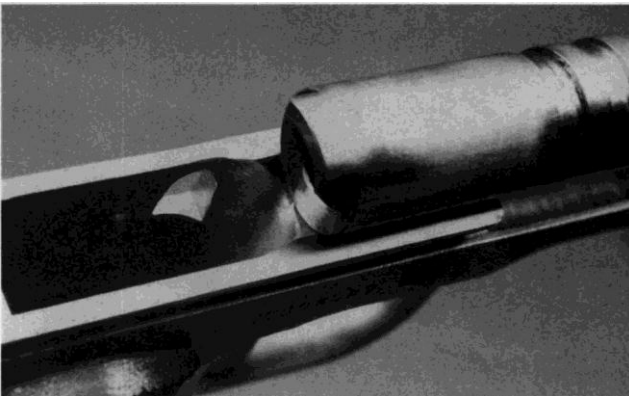
Check the slide stop to make sure it passes over the front shoulder of the lower lug.



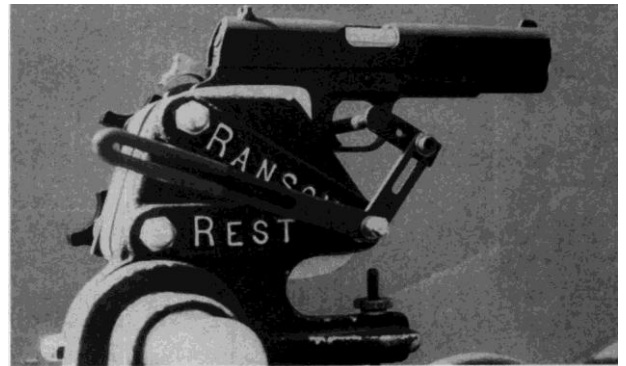
If the slide stop won't pass over the shoulder, file here.



If the barrel binds on the slide after unlocking, the slide stop is probably hitting the front face of the bottom lug.



When your new barrel links back and is unlocked, there should be a gap between the top of the frame ramp and the bottom of the barrel ramp.



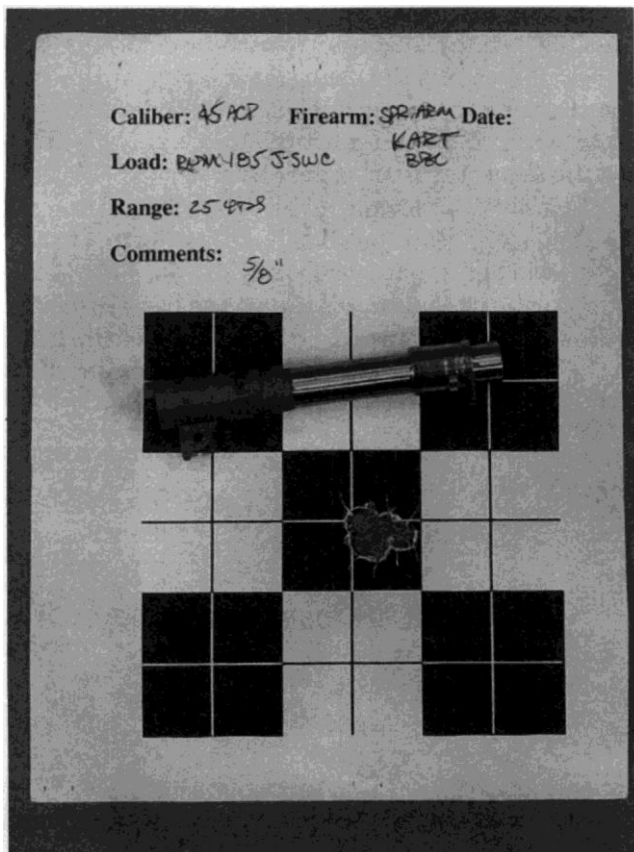
Here the Springfield 1911A1 is in the Ransom rest getting ready to test the Kart barrel.

With the proper link installed, check the fit of the slide stop to the front corner of the cut lower lug. During unlocking, the slide stop must clear this corner. Cutting the lower lug left it too sharp and too far forward. Now you must file it just enough to allow the slide stop to pass over it.

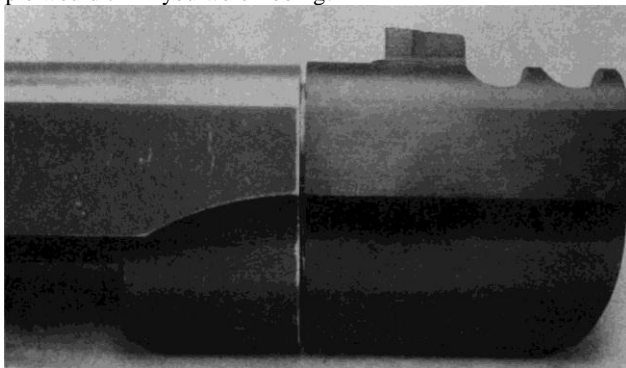
Install the slide and barrel on the frame. Install the slide stop. Run the slide back and forth, checking to see that it moves smoothly. If the slide hesitates during locking or unlocking, the front corner of the lower lug still needs to be filed. If the barrel rubs on the inside of the slide during movement the slide stop is hitting the front face of the lower lug.

Once the slide moves smoothly check the fit of the barrel feed ramp to the frame feed ramp. There must be a small gap. If the barrel is flush with or overlaps the frame, feeding will be poor. File the bottom of the barrel feed ramp until there is a gap between the top of the frame ramp and the bottom of the barrel ramp. Re-cut and polish the barrel feed ramp, but do not extend the top edge of the barrel ramp any farther into the chamber than it already is.

Completely reassemble the pistol and take it to the range for a test-firing. After a box of ammunition, take the pistol apart and check to see whether the lower lug is banging against the slide stop. If it is, stone the contact spot to keep the parts from battering each other.



A correctly fitted Kart barrel delivers accuracy like this. Any better, and people would think you were fibbing!



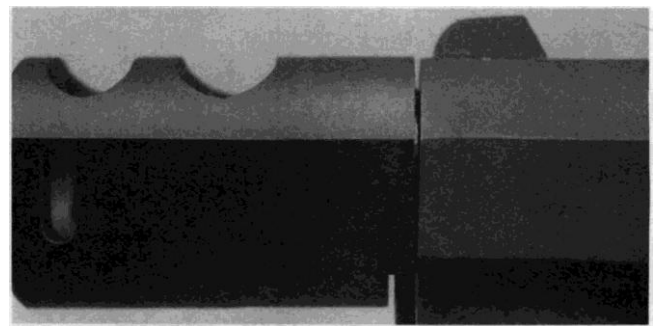
If this gap is too large for your tastes, you'll have to turn the compensator down another turn and file the back to provide just enough clearance.



This Clark barrel comes with the compensator already attached, and is meant to be a drop-in unit. Pull your old barrel out, put this one in, and check to make sure the new one links down properly. If it does, go to the range and shoot. If it doesn't follow the barrel fitting procedure to find out why.



Clark makes accurate barrels in a variety of calibers.



Simply dropping the Clark comp kit into this Springfield gave us this much gap. You can set it back if you want to.

Compensators

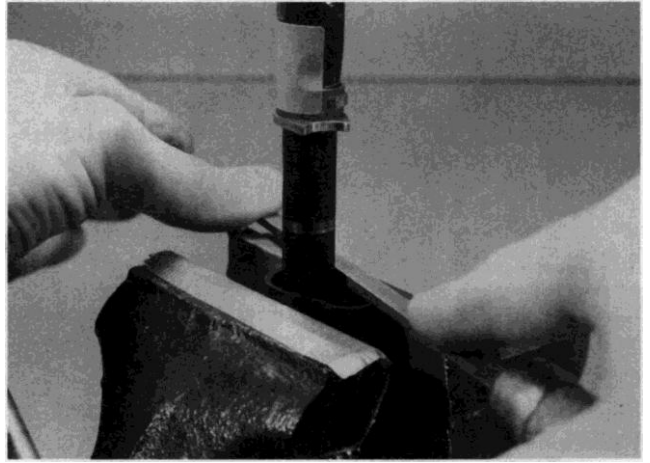
Even though barrels are available with compensators attached (see photo) you must remove the comp when fitting the barrel. A compensator is fitted only after the barrel has been completely fitted and test-fired.

Screw the compensator on until it touches the slide or barrel bushing. Lock the slide back, turn the compensator clockwise until it is upright, and gently close the slide. Does the comp touch the slide? If it does, you must either unscrew the comp one turn, or use your file to remove the contact.

Try unscrewing first. Lock the slide back and turn the comp out one full turn. Close the slide. Can you live with the gap? If you can, mark the compensator's position. Unscrew it, and degrease the threads of both the barrel and comp. Apply Loctite to the threads. Screw on the comp. Wipe off the excess Loctite. Close the slide and check the alignment of the compensator. Open the slide to allow the Loc-tite to set. If you keep the slide closed the Loctite will wick between the barrel and bushing and lock it shut.

If the slide-comp gap is too large, screw the comp down a turn. Use a candle to smoke the back of the comp. Gently close the slide. Open the slide and look at the marks in the smoke. Use your pillar file to dress down the high spots. Repeat until the smoke is not marked by the slide. Secure the compensator as above.

There can be no contact between the slide and the compensator. If they touch, every time the slide closes it will bang against the comp, driving it forward. You might only end up with a slightly peened comp. On the other hand you could crack the barrel in the threads.



Filing the back of the compensator to clear the slide.

Improving your trigger pull

Improving the trigger pull of your 1911 often has nothing to do with the trigger. You can perform a very good “trigger job” on your 1911 working only on the hammer and sear.

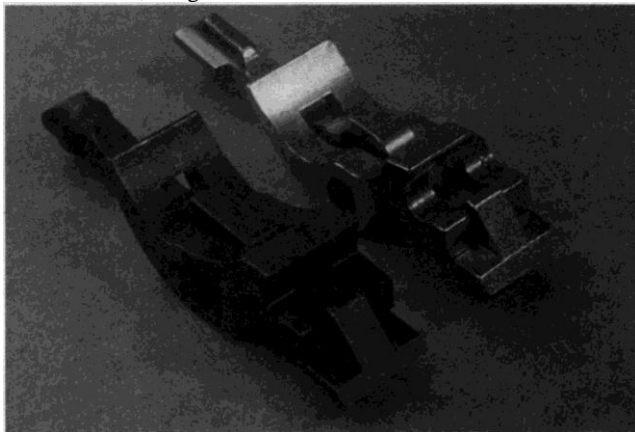
Lightening the trigger pull on a 1911 used to involve a great deal of work and a certain amount of hazard. If, after laboriously fitting the hammer to the sear the work was not quite perfect, the pistol would occasionally fire more than one round for each pull of the trigger.

Now, you needn't worry about the hazard or the work.

The easiest way to improve your trigger pull is to buy the right parts. All hammers and sears used to start life as little lumps of steel that were then machined into final form. Chip McCormick changed all that when he pioneered the use of the wire EDM process to create match-quality hammers and sears. Starting with precision-ground flat plates of hardened steel, Chip used the wire of the Electrical Discharge Machining process to cut a perfectly-shaped hammer or sear out of the plate. From the package, you can drop these parts right into your pistol, check the operation of thumb and grip safeties, and enjoy your new trigger pull.



Replacement match hammers. Left to right: Wilson, Chip McCormick, Cylinder & Slide, Kings.



The correct relationship of the sear and disconnector. The left ones are Chip McCormick, while the right ones are Cylinder & Slide.



The Nowlin drop in trigger kit. Everything you need for a match trigger pull in one package.

Stoning a hammer or sear from Chip not only wastes your time, it voids the warranty.

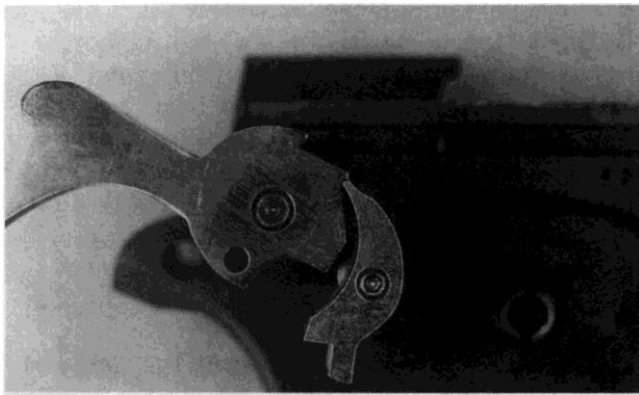
Chip is not the only one to make such golden parts. You can get hammers and sears from suppliers such as Cylinder & Slide, Wilson, Kings, Ed Brown and EGW. Nowlin offers a complete trigger job in a package, which has not only the hammer and sear, but the disconnecter, hammer spring and three-leaf spring.



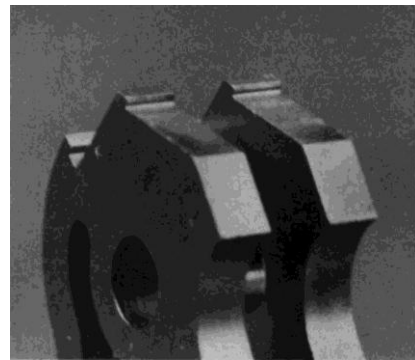
The Power Custom stoning tool is adaptable to almost every handgun in existence.



With external hammer and sear pins you can observe the hook engagement.



This is what you will be looking at.



The purpose of stoning the hammer hooks is to make them square, polished, and a known height.

Swapping parts is not always an option. Precision parts can give you a trigger pull as low as two and a half pounds, far too light for hunting. The lightness can also create problems for a relatively new competitive shooter. And if you are going to carry your 1911 for defense, do not install match parts that deliver such a light trigger pull. Stone your existing parts for a cleaner, crisper trigger pull, but one that is still four and a half pounds or more.

Proper stoning of hammer and sear requires a fixture. Ron Power makes the best. With adapter blocks, the same fixture can stone the hammers and sears of every handgun in common use. You will also need a magnifying eye loupe and external hammer and sear pins first to examine and then to check the engagement.

You stone the hammer hooks to make them square and to make their surfaces smooth. You must also shorten the hooks to a specific height. The hook height you select determines the weight of the trigger pull, the useful life of the trigger job, and the safety of continued sear engagement.

To stone the hooks square set the fixture to work the hook flats and faces. Begin with a medium-fine synthetic stone, preferably a Brownells trigger stone. The faces and edges of trigger stones are precision-ground to be flat and square. Make a few even passes across the hooks. Dykem, and stone again. Continue marking and stoning the hooks until they are even across their full faces. Switch to the extra fine stone and polish the hooks with a dozen passes.

Adjust the fixture to stone the tops of the hooks. For hunting or carry pistols, where you want a trigger pull that is clean and crisp but not too light, adjust the hook height to .020 inches. For competition, where you need a light trigger pull, adjust the height to .018 inches. The .020 inch hooks should give you a trigger pull of around four and a half pounds, while the shorter height can deliver a trigger pull of three and a half pounds. Place your feeler gauge on the hammer flats, pressed up to the hooks. Stone the tops of the hammer hooks using the medium fine stone. Stop when the stone reaches the feeler gauge.

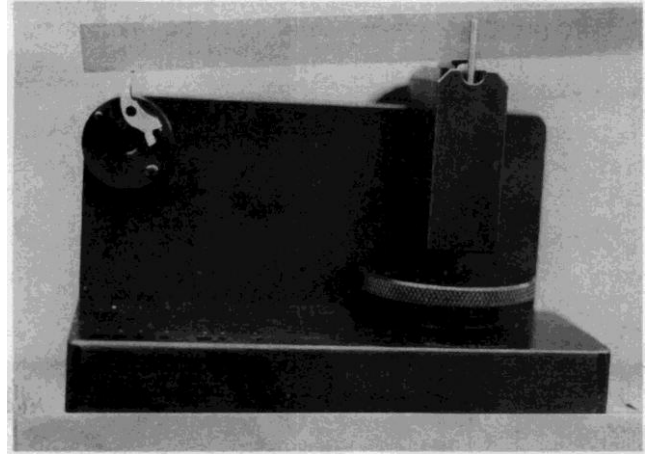
To keep the now-sharp hooks from marring the sear tip, take one pass across their tips and break the corners.

Put the external positioning pins into the frame, and place the newly-stoned hammer and the sear on them. Adjust the hammer and sear so they are in contact, and examine the angle of the sear tip. It should bear evenly on the hammer hooks. Adjust the sear stoning fixture so you are stoning to maintain this angle. If the sear does not contact the hammer hooks evenly, adjust the sear fixture to compensate.

Stone the sear for four passes with the medium fine stone, and recheck hammer/sear engagement. If necessary, adjust the sear fixture again to the correct angle to the hammer hooks. With the correct angle locked in, stone the sear until it bears across the full width of the hammer hooks. Switch to the extra fine stone and polish the sear tip for half a dozen passes.

Remove the sear from the fixture. Place it against the medium fine stone with only its tip and foot making contact. Take two or three passes to stone the escape angle. By beveling the inside tip of the sear you create a surface for the hammer hooks to cam the sear out of the way, reducing wear on the sear and prolonging the life of your trigger job.

Clean and lubricate the hammer and sear, and install them in the frame. Perform the hammer and safety checks discussed in Chapter 4, and if necessary adjust your thumb safety to the new hammer/sear engagement.



Property stoning the sear requires a fixture such as this Series 1 from Powers.

Installing a beavertail grip safety

Jeff Cooper once remarked that the beavertail name was wrong. The wider grip safeties looked like ducktails. Too bad “ducktail” is already in use to describe a haircut from the 1950’s. We are stuck with beavertail.

The grip safety in the 1911 encloses the trigger and provides an additional safety mechanism that precludes the pistol’s firing unless it is held. With its wider area the beavertail grip safety adds comfort and control by spreading out the recoil forces. It also keeps the pistol stable in your hand, speeding up accurate rapid fire.

Beavertail grip safeties change the way your hand fits the frame. When combined with a thumb-over the thumb safety shooting style the grip safety does not always work properly. If your hand doesn’t contact the grip safety at the bottom the safety won’t unlock from the trigger. Your pistol will not fire. To prevent this problem, grip safeties are now available with a lump at the bottom. The lump fills the gap. If you have trouble contacting the grip safety at the bottom, because of your grip or the size of your hands, you must get a beavertail grip safety with this lump.

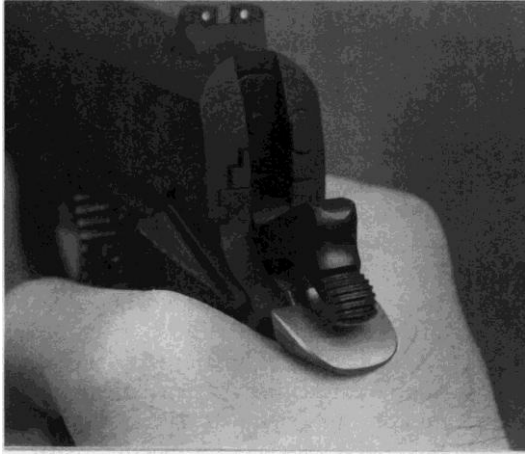


This Ed Brown grip safety will get your hand higher on the frame than a standard safety, (photo courtesy Ed Brown)



Three grip safeties. The standard on the left protects your hand, but isn’t as efficient at aiding your shooting as the other two. The McCormick in the middle is much less sensitive to improper grip. The swelling goes far enough up that any hand will depress it. The Ed Brown on the right lets your hand get higher on the gun, but not everyone hits the pad on the bottom. If you don’t push the pad, the grip safety will not unlock the trigger.

The Chip McCormick grip safety incorporates this lump as part of the curve of the grip safety. Called the “de-activator” it allows the grip safety to do its job regardless of how you hold the pistol.



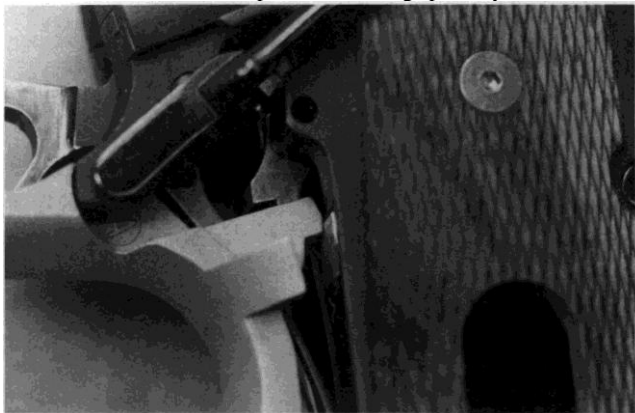
The Kings drop-in beavertail will work with a spur hammer. It is a useful addition of an otherwise stock pistol.



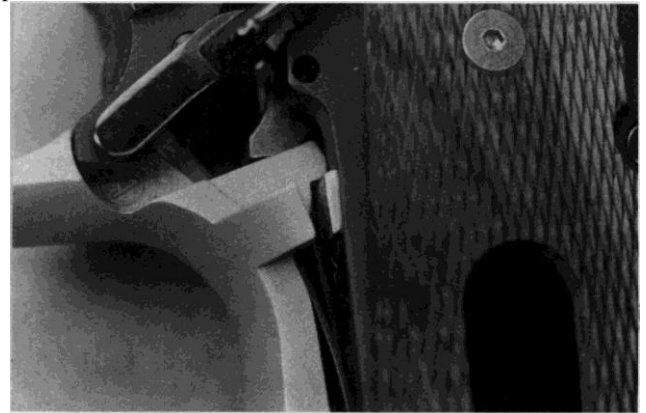
A side view of the Kings drop-in safety.



This Wilson drop-in beavertail grip safety will not work with a spur hammer. You must switch to a commander hammer.



With the grip safety not depressed, it is pushed by its spring and interferes with the travel of the trigger.



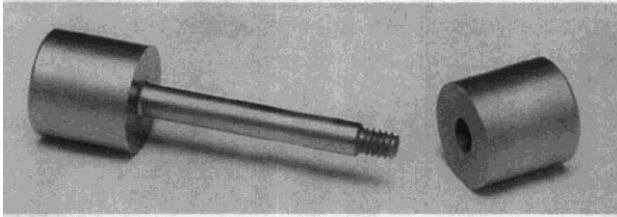
Here the grip safety has been pressed, and the trigger can travel under it to release the sear.

Beavertail grip safeties come in two basic types. The drop-in does not require any frame modification. Simply remove the old grip safety, install the new one, check for proper engagement of the grip safety to the trigger, and enjoy. Wilson and King both offer drop-ins available in blue or stainless. There are some minor design differences, and not all drop-in beavertails work with spur hammers. For the latter to work you must install a commander hammer.

Drop-in beavertails do not fit snugly to the frame, and some shooters find the gaps objectionable or uncomfortable. The alternative is to modify the frame for a better fitting beavertail.

The sleeker beavertail grip safeties all require grinding, milling or filing the tang of the frame on a .250-inch radius from the thumb safety hole. Having done that, you face two more options: Ed Brown's style and everyone else's.

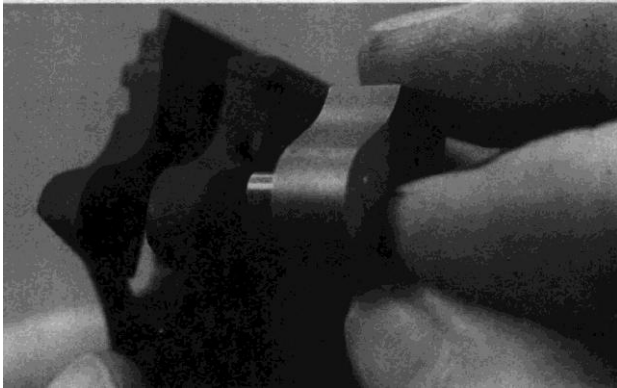
The Ed Brown grip safety is far more curved under the tang than those from other manufacturers. To install a safety from Ed you have to file and polish the frame under the tang to blend the edges. Other grip safeties do not require blending under the tang. Why is the Ed Brown shaped this way? Simple. The greater curve lets you get your hand higher and tighter to the frame, affording many shooters greater comfort and added control. Others see no improvement, and have no need to go to the extra trouble of fitting the Ed Brown.



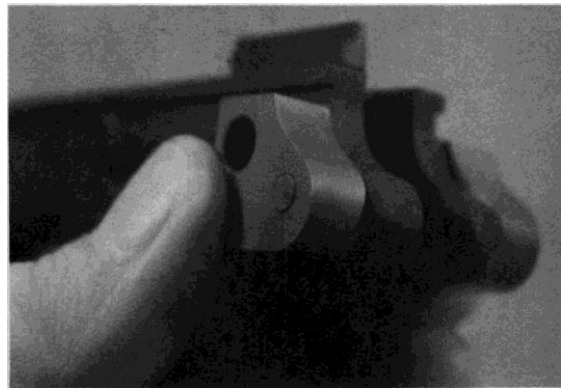
The Ed Brown grip safety guide will let you grind your frame with a bench grinder, and then file it without going too far. (photo courtesy Ed Brown)



Wilson makes beavertails and the fitting jig to get it on your frame correctly.



Press the right hand side onto the stripped frame.



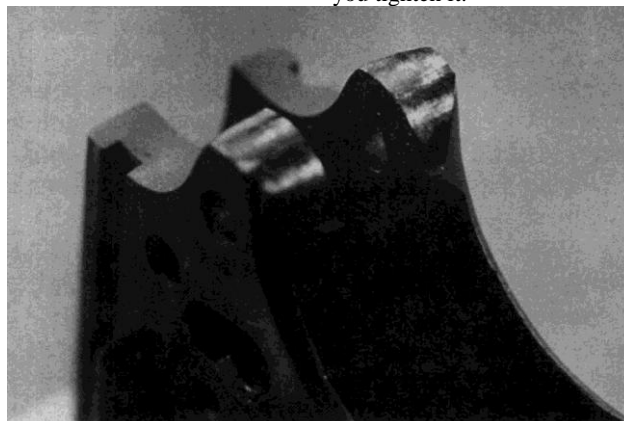
Slide the left side on and press the top edge flush with the slide rails.



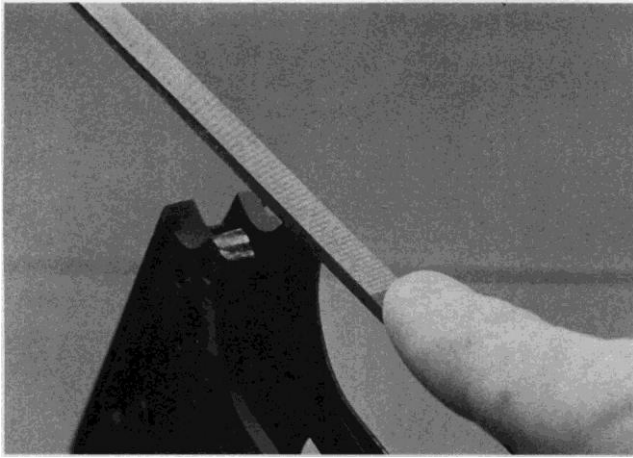
Tighten the locking bolt.



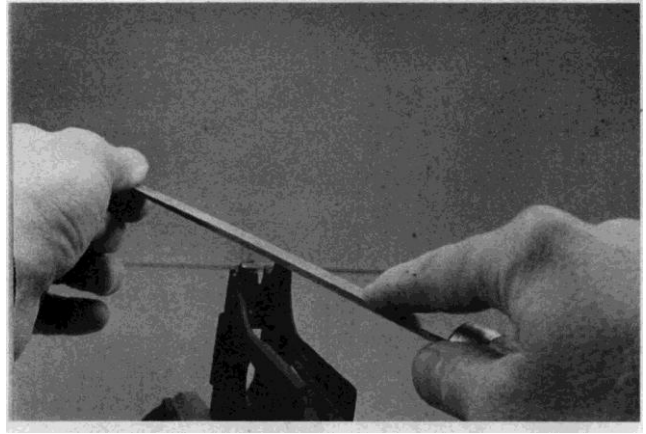
Make sure the top edge of the fitting jig is parallel to the rail slot when you tighten it.



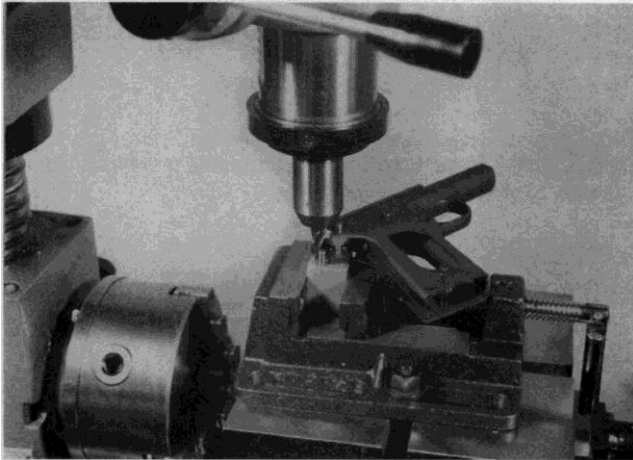
The ground and filed frame tangs, smoked to check fit of the grip safety.



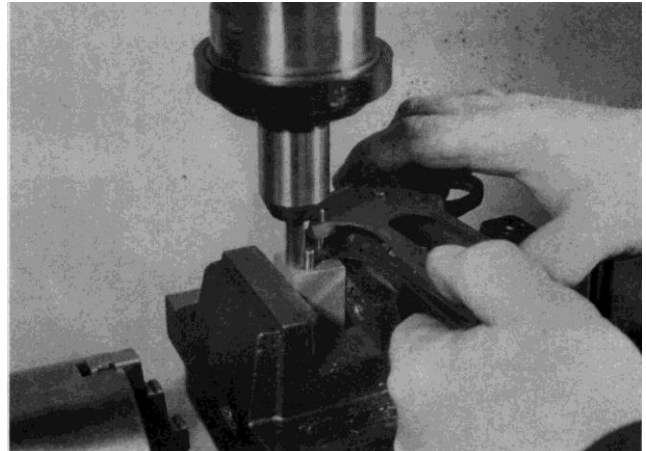
File the high spots rubbed bright by the grip safety.



Grasp the file with both hands, and follow the curve.



Here the Cylinder & Slide grip frame fixture is being used to cut a Springfield frame.



At 1600 rpm, the carbide cutter makes quick work of the frame tangs.

The installation of a non-drop-in beavertail grip safety begins the same way regardless of the brand. You can grind and file or you can mill. If you intend to grind and file, when you order the grip safety also order a beavertail fitting jig to guide you in your grinding. Strip the frame, install the jig, and fire up your bench grinder. Grind the frame down to the jig without touching the jig.

Use your pillar file to dress off the metal on the edges of the frame kicked up by the grinding wheel. With a candle smoke the freshly-ground surfaces. Press the grip safety in place and remove it. File the contact points left bare of soot. As you work your way down, be sure to file the surface to a smooth radius. After a couple of smoke and file turns, start checking the thumb safety to see if it goes through the pivot hole of the grip safety.

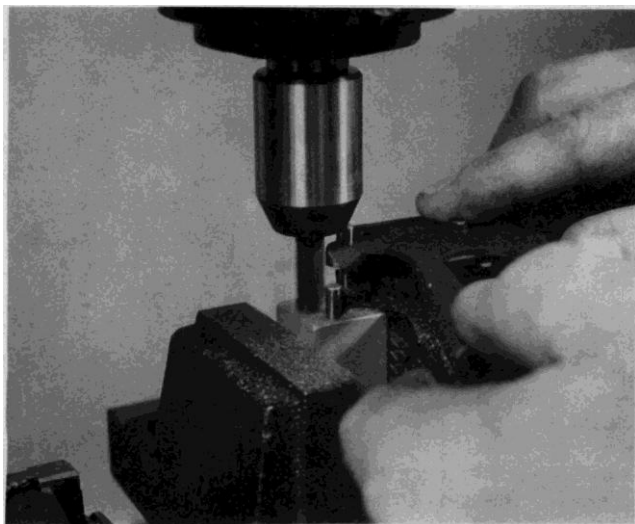
When you get to the point that the thumb safety will insert, pivot the grip safety to check for high points on the radius. Also check to see if the grip safety is binding on the frame opening. If so, file the safety until it moves smoothly.

Pull the thumb and grip safeties off and install the trigger. Reinstall the two safeties and look through the frame opening. Press the grip safety and attempt to pull the trigger. The trigger should pass under the grip safety extension. If it doesn't, file the bottom of the grip safety extension to provide clearance. Install the mainspring housing. Pull the grip safety up. It should pass behind the trigger, preventing it from moving back.

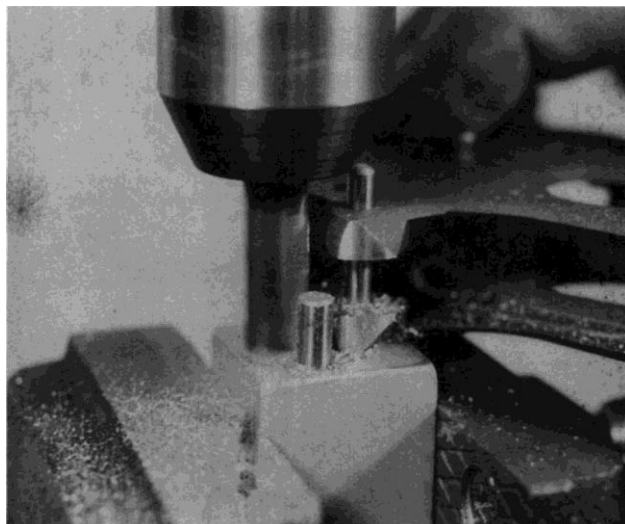
As with so many things, power tools and the right fixtures make life easier. If you have a mill and are planning to do more than one beavertail grip safety installation, buy a grip safety fixture. Mine is from Cylinder & Slide. Other manufacturers make similar products. To use, clamp the fixture in your mill and install an end mill. Because of its speed and ease of use I prefer a carbide end mill. The thumb safety hole of your frame goes over the pivot pin on the fixture.

Position your cutting tool .185 inches from the fixture's pivot post. Wearing a pair of heavy gloves, set the frame on the pivot pin, turn on the mill, and rotate the frame against the end mill. When you are done de-burr the new cut. Check the grip safety for fit. The cut should be close, but the thumb safety will not yet fit through the frame. Move your milling table .005 inches in and repeat the process. Continue .005 inches at a time until the thumb safety fits.

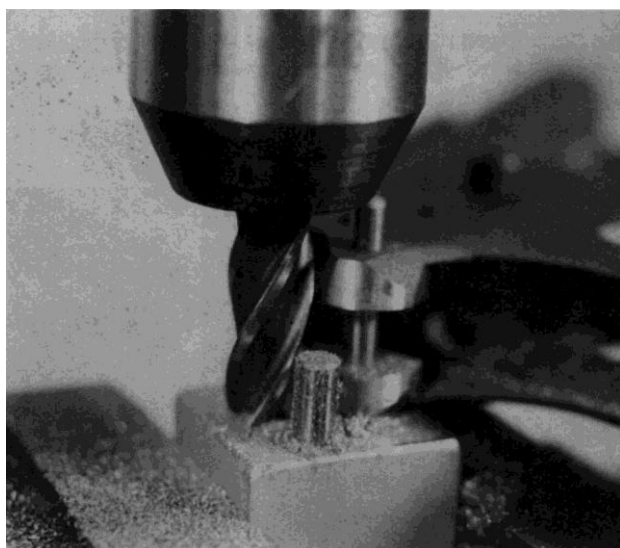
Fitted this way the gap between your frame and the grip safety will be less than .005 inches. Usually the grip safety looks as if it grew out of the back of the frame. For an even finer fit, as soon as the thumb safety pin can be forced through the grip safety pivot hole, do not use the mill any more. Place lapping compound on the tang of the frame, install the grip safety and the thumb safety, and work the grip safety back and forth. Once the grip safety moves easily, clean off the lapping compound and check the fit. You are done when the grip safety moves freely. This attention to detail separates the good pistolsmith from the Master pistolsmith.



Simply rotate the frame around the pivot pin.



Here is the first cut.



The next cut is deeper.



Here is an Ed Brown grip safety with the radius cut on the frame tangs, but no other blending done. You can see how much of the sides of the frame have to be ground and polished down, to blend the edges. Once this is done, the frame will sit lower in your hand.

The Ed Brown difference

The Ed Brown requires more work. Install the thumb and grip safeties. Press the grip safety all the way into the frame. It will go past the edges of the frame. Since these edges are very sharp, you cannot shoot the pistol without blending them to the grip safety.

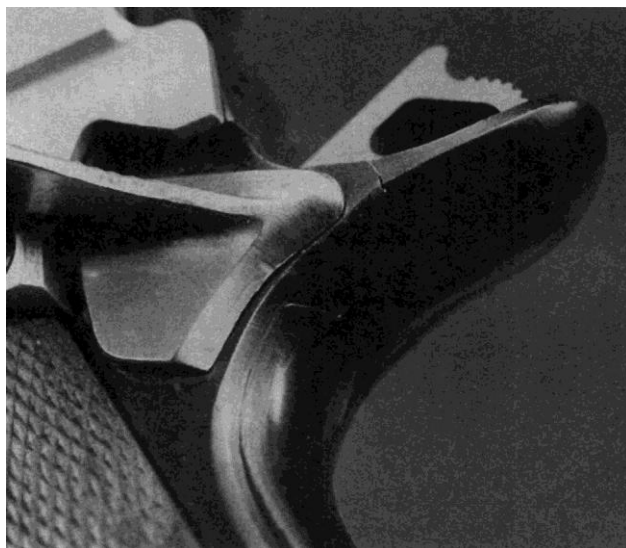
Place masking tape across the bottom of the grip safety to hold it down. Put the frame on your holding bar. Use grinding stones or a sanding drum in your hand-held grinder to reduce the edges of the frame. You want them flush to the grip safety. Once you've blended the frame look at the thumb safety. You will have to grind its rear curve to match the curve of the frame. Once all the edges are blended, switch to 220 grit cloth and polish the frame, thumb safety and grip safety.

Unlike the installation of other grip safeties, once you are done installing an Ed Brown you will have to refinish the frame.

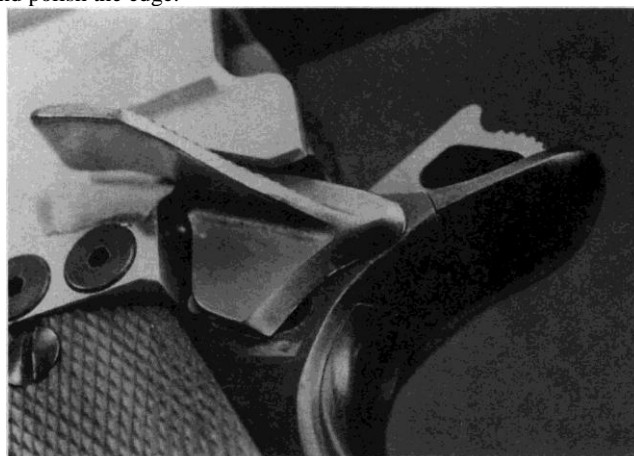
Which beavertail grip safety is the right one for you? You will have to try the pistols of other shooters at your club, with a variety of grip safeties on them, to find out what works for you. You may well find that while any beavertail grip safety improves your shooting, you notice no difference between the brands.



If you have a standard thumb safety on a frame with an Ed Brown grip safety, the thumb safety will hang over the back of the frame. You have to file or grind the thumb safety back, and polish the edge.



When you have finished, the thumb safety will fit the curve of the grip safety, but....



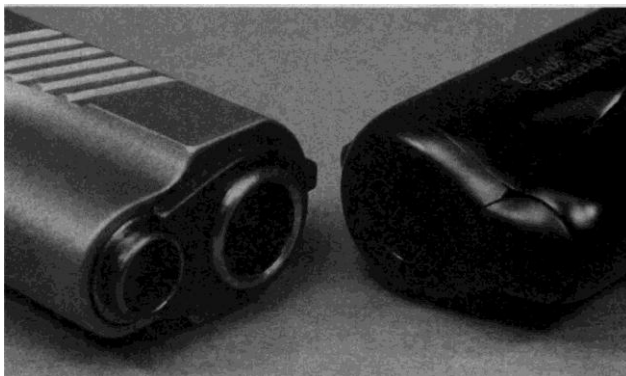
when the safety is on, the safety lug hole is partially uncovered. This is a cosmetic problem, not an operational one.

The Combat Meltdown

Shooters with tender skins hate sharp edges. Even without tender skin, those who must wear a pistol eight to 18 hours a day also find every sharp edge that exists.



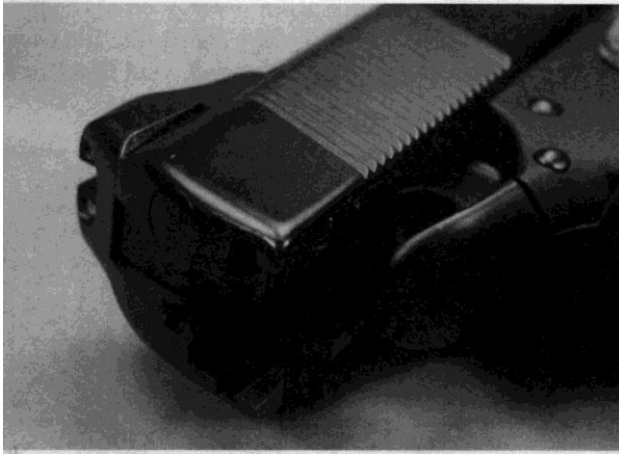
The Clark Custom Guns "Meltdown." The front of this slide has been fitted with an over-sized bushing, and rounded like a bar of soap.



The Clark Meltdown compared to a standard 1911.

Basic de-horning simply breaks edges and radiuses them. More is required for sensitive skin or daily carry. Every sharp edge must be removed. Every one. You must be ruthless. You cannot look back. Ever seen the “Meltdown” by Clark Custom Guns? Except for being blued steel, it looks modeled after a bar of soap. Use this as your model.

Before you take the pistol apart, rub your hands over it. Mark the edges needing beveling with a felt-tip pen. These will be your guides to filing.



The back of the slide has been rounded as well.



The reverse plug recoil spring retainer has been artfully blended to the bushing and slide.

Start with the slide. File a .065-inch wide bevel on the back edges and bottom rail. On the front of the slide either file the slide itself, or install a bushing the same size as the slide and file the bushing flange. Clark combined the bushing flange approach with an extended recoil spring retainer, and rounded the retainer, too.

After you have beveled the edges go back and slightly round them with the file. Switch to 220 grit cloth and use a shoe-shine motion until they are smoothly blended. Repeat with 320 and 400 cloth.

Do the same thing to the frame.

The sharp edges of the hammer will have to be rounded to keep them from rubbing you raw. Do not round the base of the hammer, which rests inside the frame.

Round any remaining felt-tip markings.

Before you have the pistol refinished, take it to the range and shoot it to make sure you've gotten everything. If you carry your pistol, wear it for a few days to be absolutely sure you've eliminated every nasty edge. It is expensive to address “one last” problem after it has been sent to the plater.



The Clark Meltdown, not a sharp edge in sight.

Get a grip—Part 2

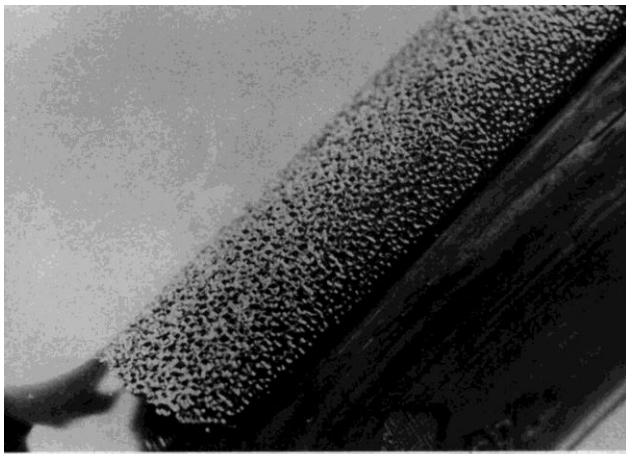
Skateboard tape and clamp-on panels work to keep your grip from slipping, but they aren't quite permanent. To make a permanent change in the grip of your 1911 you must work on the metal of the frame. Once a frame has been altered, however, you are stuck with it. You can't go back and re-do it the other way. Before you begin, be sure of what you want.

Stippling has much to recommend it. To stipple the frame you need a centerpunch and a ballpeen hammer.

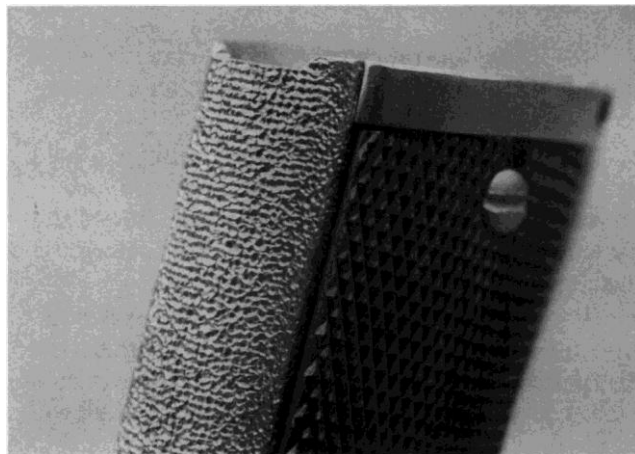
If you are locating a spot for drilling, you hold the centerpunch directly against the metal and strike it. In contrast, to stipple you must hold the punch half an inch away from the frame before striking.

Right-handers begin by holding the punch in your left hand as if you were trying to write with it. The point will be up, where a pencil eraser would be. Turn your hand over, resting the back against the frame or vise. From this position, the blow of the hammer drives the punch into the frame, leaving a mark, and your flexed fingers pull the punch back from the frame, ready to strike again. Move the punch over slightly and strike again. Left-handers must begin by holding the punch in their right hand.

You do not have to swing the hammer very hard to make an impression. The harder you strike, the larger the mark. In the center of the area you will stipple, swing briskly. At the edges, tap the hammer, so you can precisely control the location of the strike. Once you have a feel for the technique, all you have to do is repeat it several thousand times. If the tip of the punch becomes dulled, stop and sharpen it.



The stippling was applied to provide a non-slip surface. Then the pistol was given a Bearskin finish. Jet black, it doesn't slip and is easy to clean.



Stippling can be re-done and gone over. You can even use stippling to salvage botched checkering. This pistol had truly ugly checkering, with wavy lines at odd angles. Stippled, the ugliness is hidden, and the surface is nonslip.

It is not just the tip of the punch that will become dull. Stop when your arm gets tired. Don't hurt yourself swinging too many times in your first sessions. You may spend three hours or more stippling the front of your first frame. As you become more familiar with the technique you will speed up. The last time I stippled a frame, it took a little less than forty-five minutes, but I've been swinging a hammer for many years now.

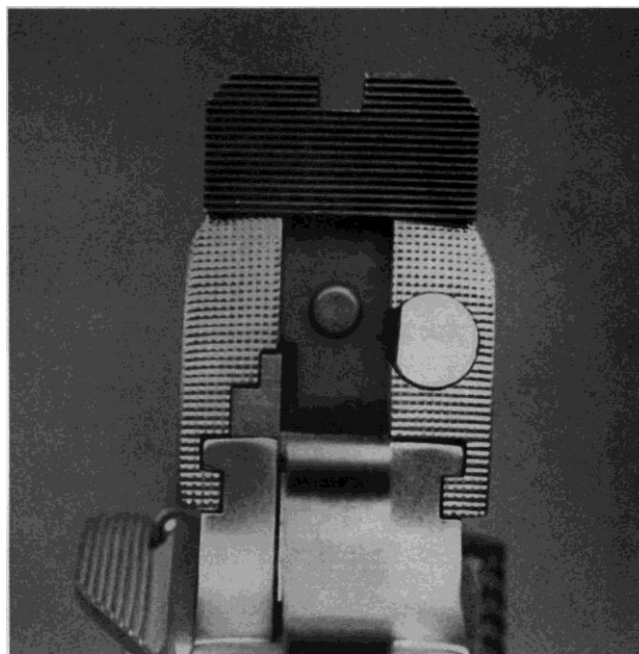
The beauty of stippling is that you can always go back and fill in any areas that you didn't completely cover during the last session. If you want to spread your stippling work over the course of several weeks and a number of trips to the range, no problem. If after you get a better feel for the technique you want to give the frame a coarser, heavier stippling, just stipple right over the old work.

Checkering, king of the grips

Checkering is both hard and demanding work. Unlike stippling, in checkering it is impossible to correct any mistakes. The work requires a checkering file, with the number of lines per inch of the pattern cut into the file. To checker, work the file over the frame, keeping the lines straight, and filing parallel grooves.

Simple in description, checkering can be very difficult to execute. The beginning of the process requires a heavy but steady hand on the file, while the end requires a delicate touch and much time spent peering through your magnifying visor.

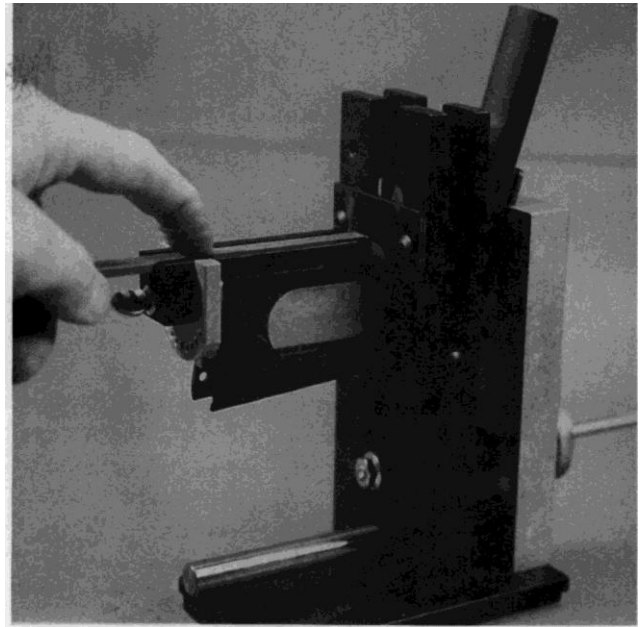
If you are going to checker, spend the money on a checkering guide. The best is made by Nowlin. Without the guide, you have only your hand and eye to keep the lines of your checkering straight. You may feel like you're going crazy and until you learn the technique you will checker wavy lines. No doubt about it. If you cannot afford the checkering guide but must have a checkered pistol practice on mild steel bars. Buy one or two from Brownells, in .750-inch width, and checker these until you are happy with your efforts. Then start on your pistol.



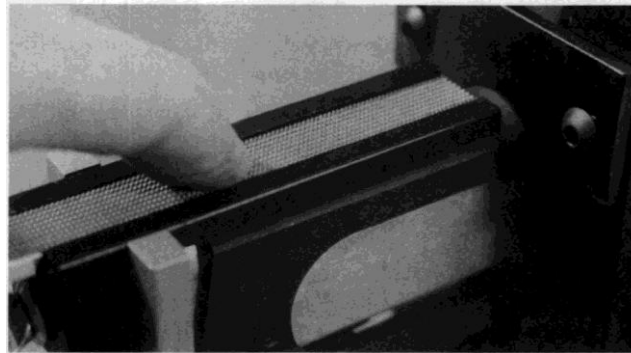
This slide oozes elegance. Lowered and lapped to the frame, the rear has been checkered 50 lpi. The rear sight is an old Novak low-mount, and the safety is a Kings. Covered with NP3 from Robar, this pistol shoots as good as it looks.



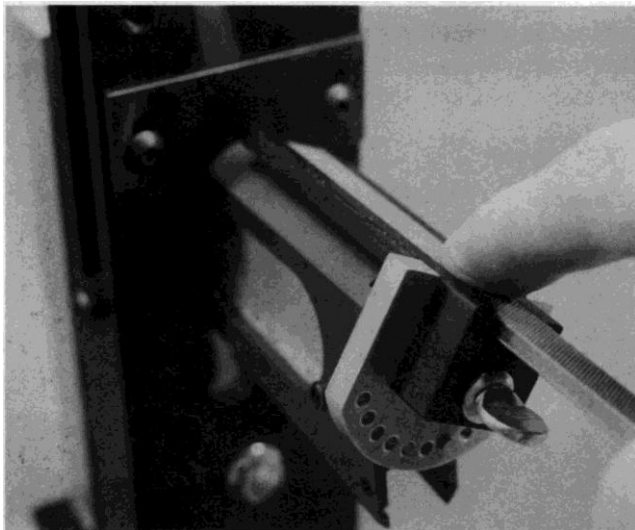
Magnifiers help you checker without going blind.



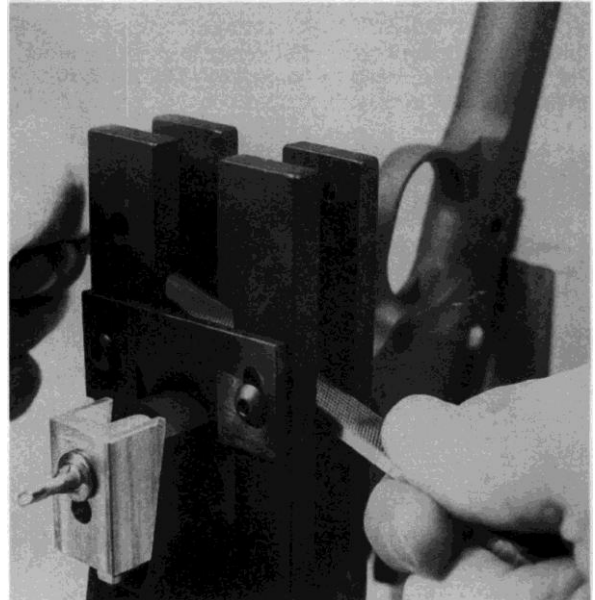
The Nowlin checkering fixture, set up to checker the vertical lines on the front of a 1911 frame.



The guide bars keep the specially-ground checkering file moving in a straight line. The top plate stops the checkering file at a consistent point.



The index holes tilt the guide the correct amount for the vertical lines to be correctly spaced across the front of the frame.



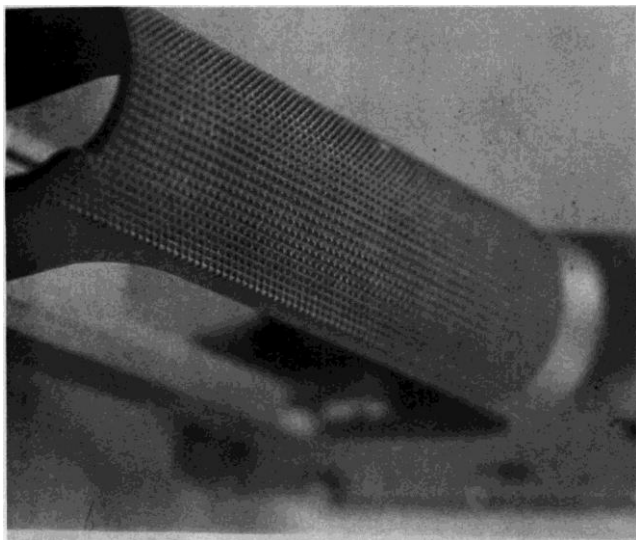
The Nowlin checkering fixture, cutting the horizontal lines on the front strap of a 1911.

To use the guide, strip the frame. Lock it in the guide. Set up to cut the verticals first. Establish the lines but do not cut them to full depth. Set the horizontal guide up, and make your first cuts near the bottom of the frame. Adjust the thumbscrew to move the guide up so your next set of lines just overlaps the first set. Continue up the frame until you have established the pattern.

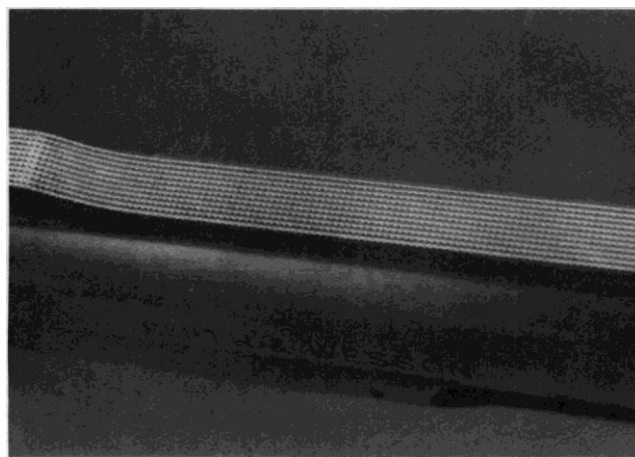
Dykem the frame and go back over the horizontal lines until you have cut them to their full depth. Switch to the vertical lines and file them to full depth.

Pull the frame out of the guide, Dykem the checkering again, and put your frame on your holding bar. Take a three-sided needle file and follow each line across the frame, gently filing the Dykem out of the lines. The Dykem will show where the lines are too shallow or too deep. Use the needle file to adjust each line in depth until all of the points are sharp, and all of the bottoms of the lines are even.

Correctly executed checkering is beautiful to behold. It is also very sharp. Correctly finished checkering will feel as if it could draw blood when you squeeze hard. For a very aggressive feel—large diamonds that can really grab your hand—checker your frame in 20 lines to the inch. Twenty lines to the inch is relatively easy to checker. A less aggressive pattern is cut 30 lines to the inch. The lines here are shallower, and more difficult to cut. The file will wander if you are not extra careful.



This Les Baer frame comes checkered 30 lpi. A beautiful job, and one you would be hard-pressed to duplicate without hours of work.

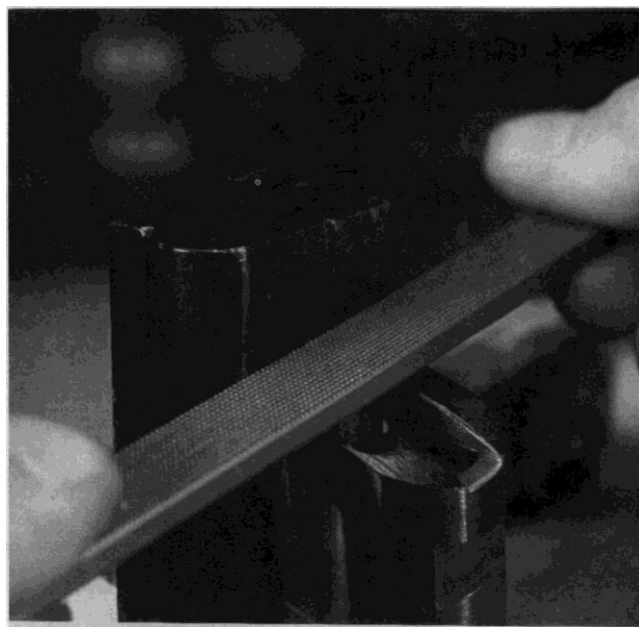


Checkering on the top of the barrel or slide cuts glare.

Occasionally someone who wants to show off checkers a frame 40 lines to the inch. It is very delicate and exacting work, and must be done flawlessly to look right. Even finer than that are checkering files in 50 and 75 lines to the inch. All three sizes are most commonly used on the rear of slides and the tops of barrels, applications which cut down glare when sighting.

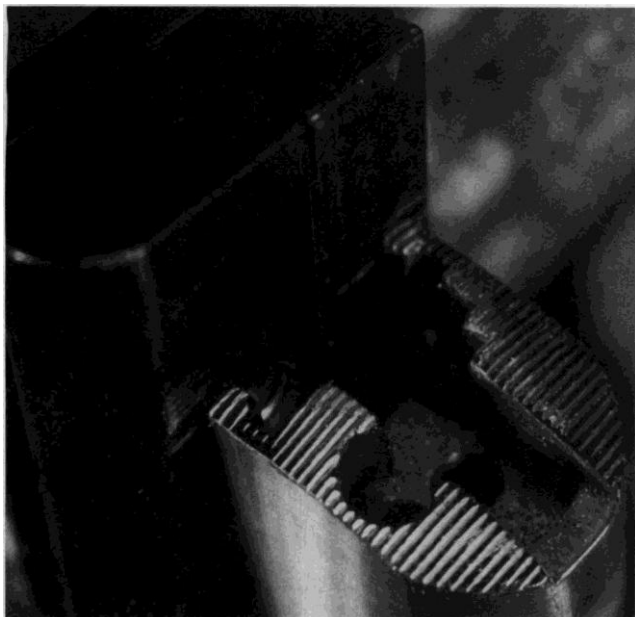


Clamp the bar and slide in the vise.

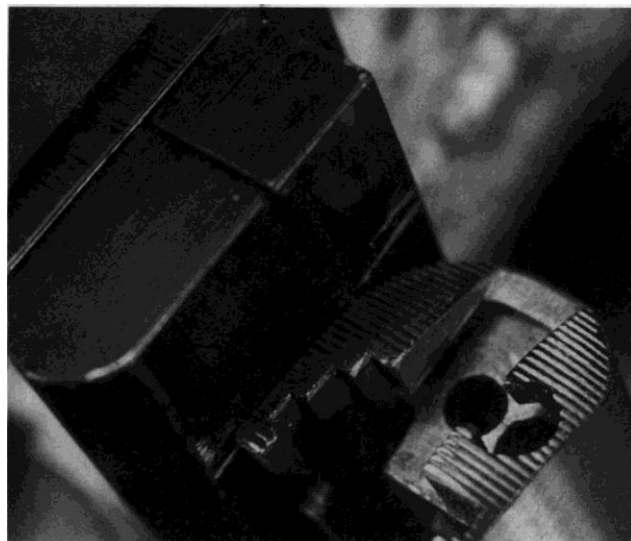


Holding the checkering file against the bar, cut the lines at the bottom of the slide.

To checker the rear of a slide, remove the slide from the frame. Take out the firing pin retainer, the firing pin, and extractor. Place a steel plate or bar against the bottom rails of the slide, and clamp the plate and slide rear end up. The plate will be your guide. Hold the checkering file against the plate and move it to the slide. Work the file back and forth, holding firmly against the plate to keep the file straight. Only a checkering file will cut in both directions.



Follow the lines you've done up to the top of the slide.



Put the side of the slide against the bar to checker the vertical lines.

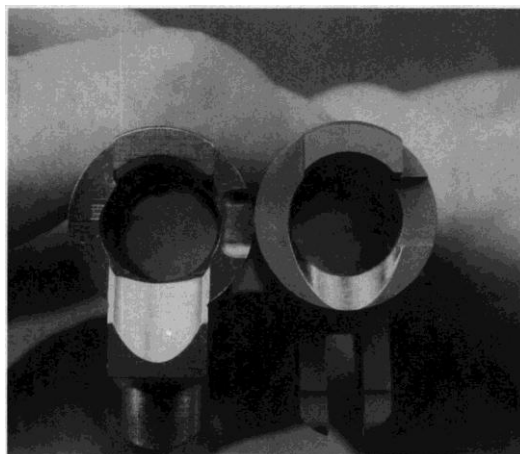
After establishing your first lines, tilt the file down to follow the curve of the slide and cut a few more. Once you have a set of lines established, pick up the file and move it over. Position it so half rests over the lines and the other half over fresh slide. Use the established lines to guide you in cutting the next lines. Proceed until you finish moving up.

Unclamp the slide and rotate it a quarter turn, so the plate is now against one side of the slide. Follow the same procedure from one side to the other. Apply Dykem and use the needle file to clean up the lines.

If you really want to checker your entire 1911, go ahead. But there are easier paths. Custom frames come already checkered. You can have a professional gunsmith checker your frame for less than the cost of a checkering guide. The professional does it more quickly and less expensively not because he is so much better with a checkering file, but because he uses a fixture in his mill and lets power and computer control cut the checkering. It's almost like cheating, but no one complains.

Ramped barrels

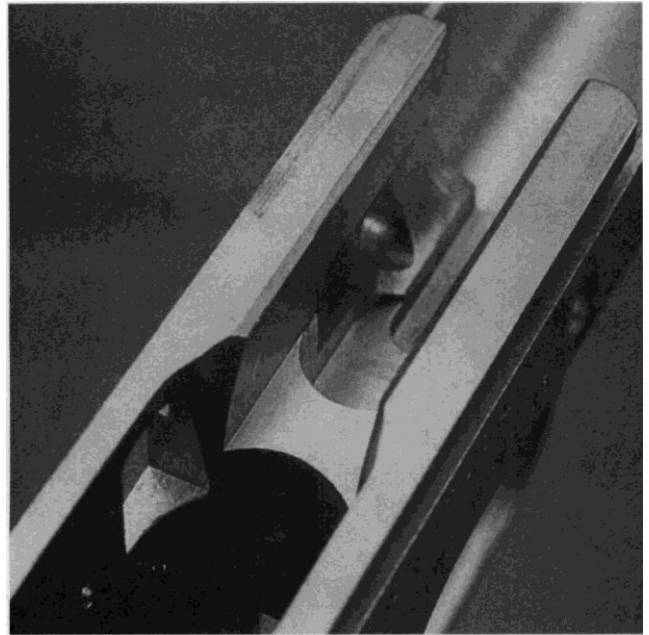
The feed ramp cut into a 1911 barrel removes steel from the bottom of the chamber. If the ramp is cut too far forward it may extend past the web, or strongest part, of the case. A hot load in an improperly ramped barrel will bulge the brass. A maximum-pressure or over load can blow out the side of the case. This usually trashes the magazine, occasionally damages the extractor and sometimes causes injury to the shooter. It is always startling.



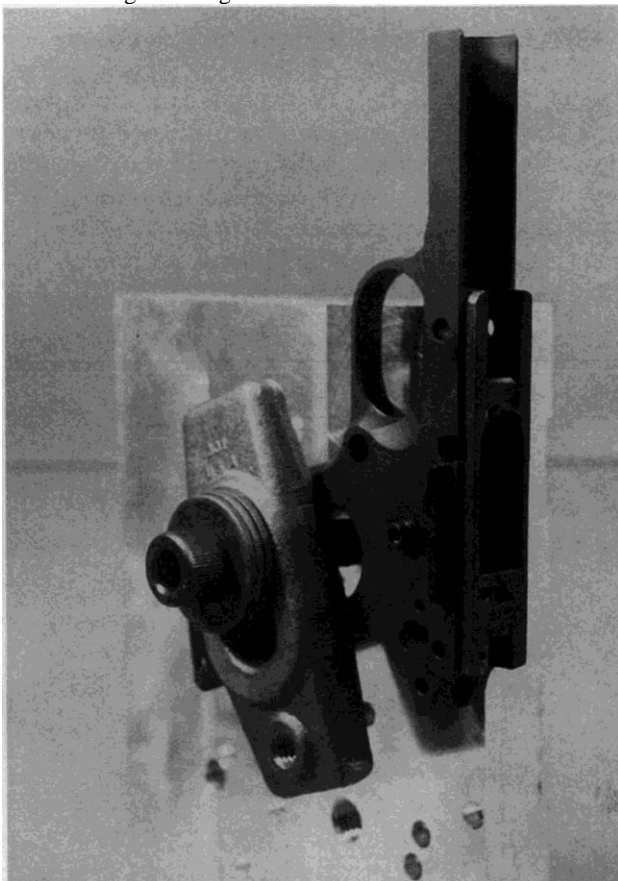
On the left a ramped barrel, on the right a standard barrel. The ramped barrel offers more support to the brass for hot loads.



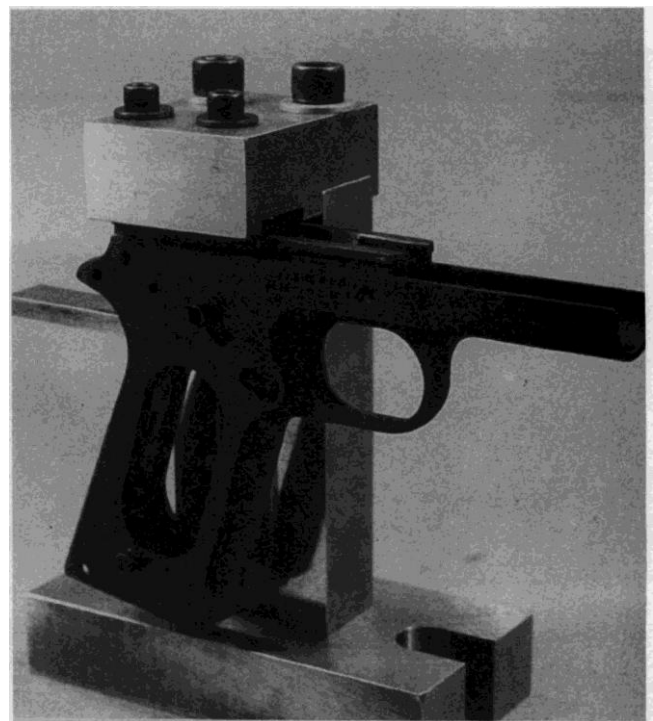
Both these barrels are in .40 S&W, but the Infinity barrel is many competitors choice because of the ramp. If you are not going to push your loads to (or past) the red line, the Kings barrel will be accurate, dependable and give a long service life.



This 1911 frame has been milled for a ramped barrel. The bullet does not have to jump the gap from the frame to the barrel, as in the original feed ramps. Here, the barrel alone has the ramp attached.



The EGW "The Plate" set up with a frame. Clamped in the mill vertically, the plate allows the ramp area of the frame to be milled out for a ramped barrel installation.

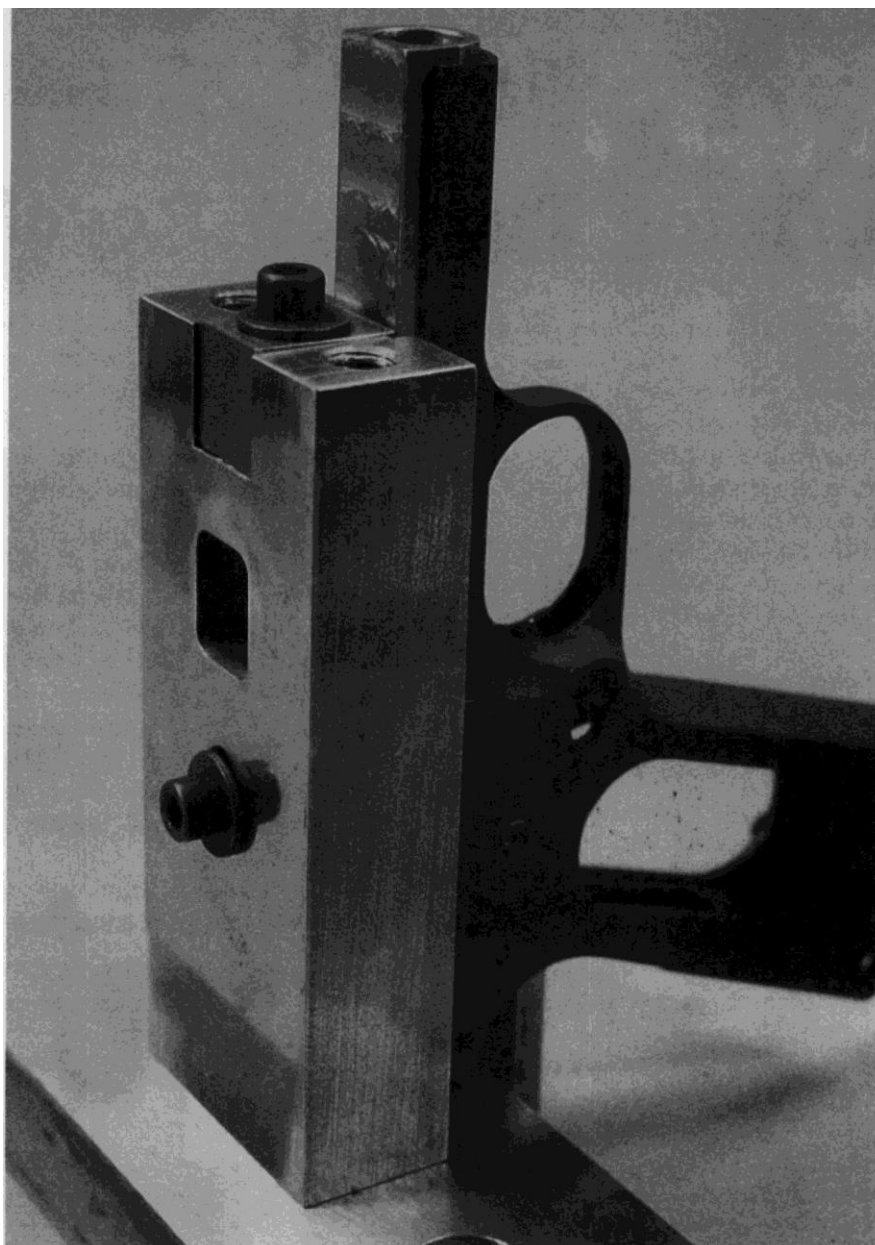


The Cominolli fixture is so sturdy I'm not sure you could hurt it running it over with a truck. The frame is held here for one of the ramped barrel cuts.

To avoid this requires the chamber walls exist all the way around the case, all the way back to the extractor groove. Unfortunately this can't be done and still have a barrel ramp that matches up with the frame ramp. Therefore, barrel makers designed barrels where the ramp is attached to the barrel. Different barrel makers use different ramp dimensions. The three main types are Clark/Para-Ordnance, Wilson/Nowlin and Bar-Sto. All the ramps work, but they are not interchangeable. As an example, you cannot simply fit a Bar-Sto ramped barrel to a Para-Ordnance pistol. You must either modify the barrel ramp or the pistol frame. Installing a ramped barrel in a frame that is not designed for one requires milling a slot in the frame to provide room for the new barrel ramp. This can only be done with a mill. An enterprising machinist could do the work without a fixture. Because the fixture makes the work so much easier it would be foolish to attempt the work without it.

One such fixture is made by Cominolli. The drawback to attempting the work without a fixture is the low height of mill vise jaws. The fixture clamps the frame high enough to keep the frame rigid, and prevent tool chatter when cutting.

Complete with instructions, the fixture allows you to mill all the various ramped barrel configurations.



The Cominolli fixture with the frame vertical for the second ramp cut. The tool can't wander, or be mis-aligned, as it has to pass down through the guide hole to reach the frame.

Chapter 20 - Accurizing The S&W Revolver

You can blame it all on Magnum Fever. Before the 1930's hardly anyone ever wore out a revolver barrel. Wear and tear on revolvers took an upward step when magnums arrived on the scene.

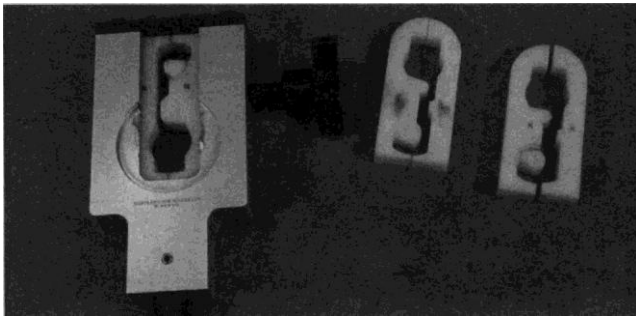
Pre-1970 someone who shot 4,000 or 5,000 rounds a year was considered a committed competitor. Today's serious competitor can easily shoot more than 25,000 rounds in one year. Around the same time police departments upped their practice and qualification requirements. Barrels really took a beating.

Magnum loads wear away the rear of a barrel. Police departments found their barrels cracking at the throat, next to the cylinder, from the combination of hot ammunition and jacketed bullets.

K-frames had been popular with police departments and civilian shooters for decades, in large part because their grip size was small enough for just about every shooter. The cylinder, barrel, and frame had survived the transition from low-pressure .38 Special ammunition to hot .357 Magnums. What K-frames couldn't take was high-volume magnum shooting.

Rarely or never before seen problems suddenly started appearing. Forcing cones were eroding. Barrels were cracking. Cylinders were going out of time right after being tuned. Even frames were cracking at their thinnest point, under the barrel.

The problem became so serious that Smith & Wesson re-designed their K-frame revolvers. The design improvements grafted the grip size of the K-frame to a frame size close to the big .44 Magnum. Called the L-frame, it was introduced just in time for the tastes of the shooting public and police departments to change to automatics. Nevertheless it is well suited to shooters with average or small hands. It sells well, and it should. Although offered only in .357 Magnum, it is the toughest .357 you can get without having to stretch your hands over the grips of a .44 Magnum-sized revolver.



The inserts let you switch from one revolver to another, with one wrench.



Brownells makes a kit that squares the barrel face and cuts the forcing cone. It works on barrels from 9mm to .45.

Setting back the barrel

But what to do with your revolver? If after your switch to magnum loads and your increased practicing you've been losing velocity and accuracy, you need to check the forcing cone and barrel. To restore accuracy you can set the barrel back and re-cut the forcing cone, or replace the barrel. If the barrel is cracked, you must replace it.

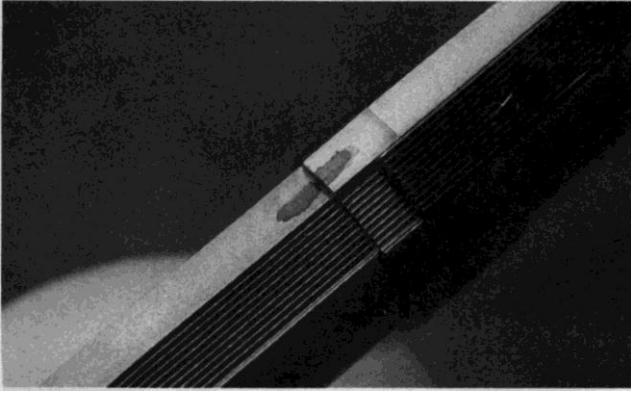
Any time you set back your barrel, or replace it, you should remove any endshake in the cylinder, (see Chapter 6)

To set back your barrel you will need a frame wrench, a shoulder cutter with the correct caliber pilot for your revolver, and a forcing cone and barrel squaring cutter, complete with forcing cone gauge in your caliber. These are all available from Brownells.

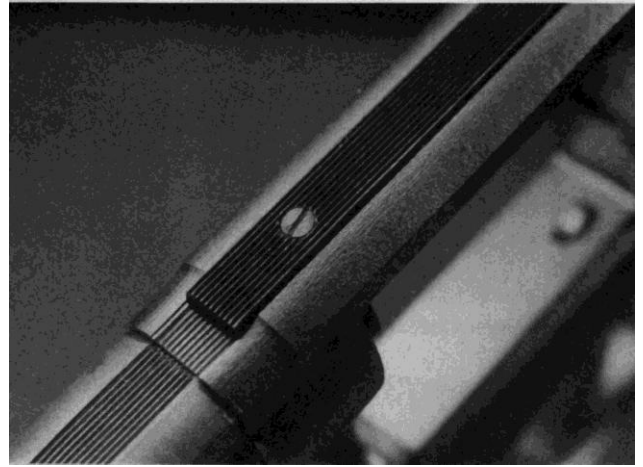
There are a few preliminaries. You must mark the location of the barrel in the frame, and measure the distance between the rear of the frame opening and the rear of the barrel. We'll call this distance the "barrel zero" distance.

First mark the location. Use a permanent ink pen to draw a line across the top of the barrel onto the frame. If the barrel has a rib on top of it, carefully note where the rib joins the frame. When you replace the barrel you will tighten it to vertical using this line.

To compute the barrel zero distance grab your dial calipers, pencil, paper, and a calculator. With your feeler gauges measure the cylinder gap. Open the cylinder and measure the distance from the rear of the frame opening to the rear of the barrel. Subtract the cylinder gap measurement from this amount to find your barrel zero measurement. This number is the maximum the barrel can protrude into the frame opening before it hits the cylinder. Save it. You will use it after setting back, or replacing, the barrel.

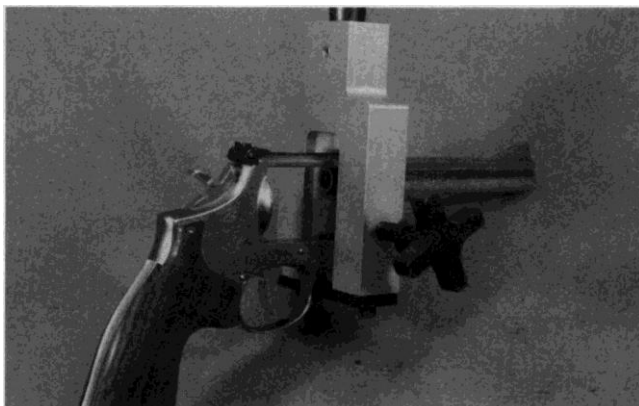


Use a permanent ink marker to locate the barrel to the frame. When you screw the barrel back in after setting the shoulder back, tighten until these lines match.

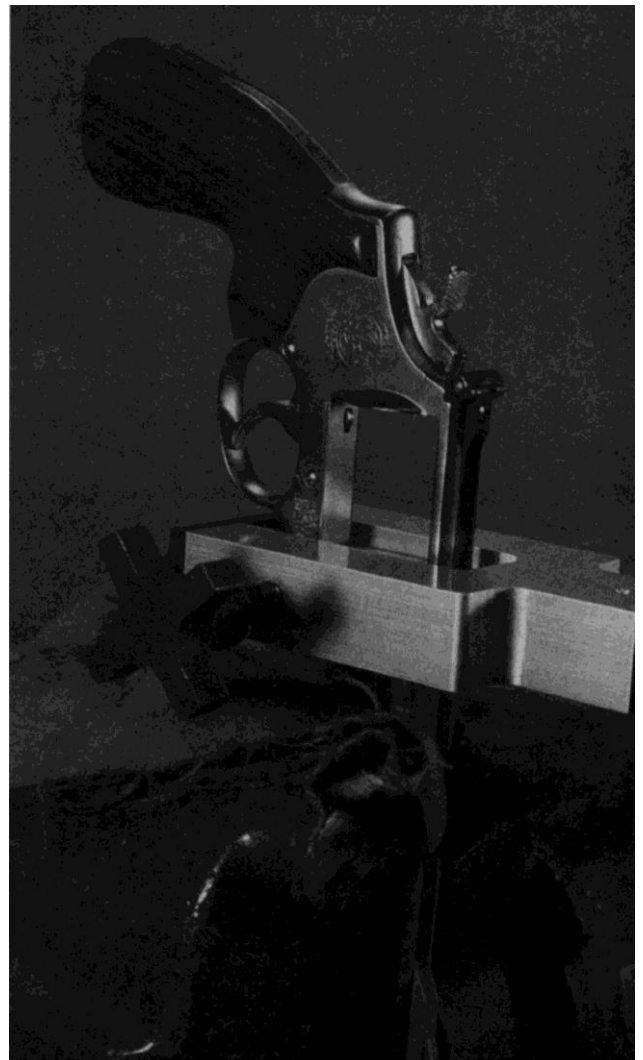


Use the lines of the rib to help record your starting point.

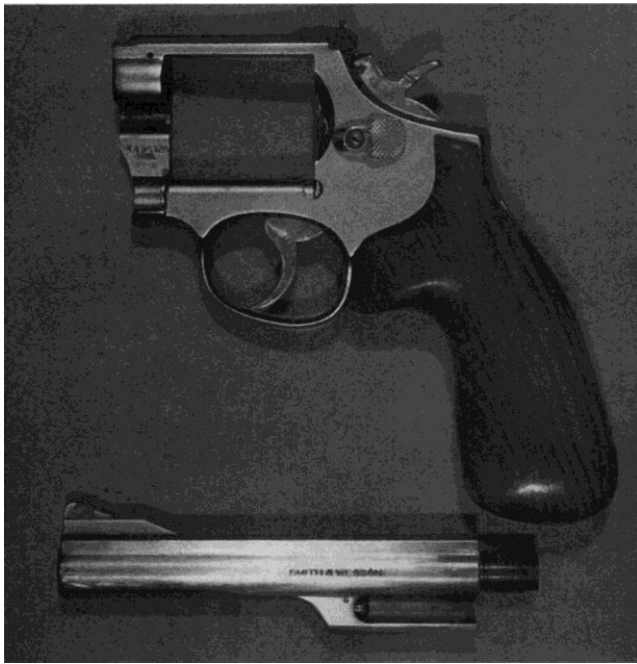
Use a frame wrench to remove the barrel. Maryland Gun Works has a good one. Do not, repeat, **DO NOT** use the barrel removal method advocated in old pistolsmithing texts—of clamping the barrel in your vise and using a hammer handle as a lever stuck through the frame opening—unless you want to bend the frame. A frame wrench comes with inserts to fit the frame of your revolver. It unscrews the barrel by holding the entire frame and not just parts of it. You cannot bend your frame using one.



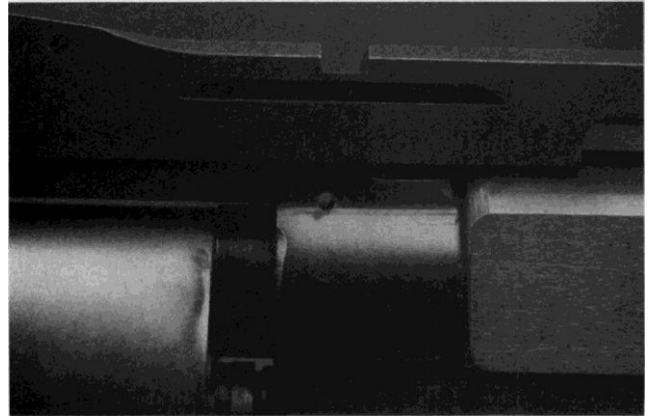
Here is the Maryland Gun Works frame wrench installed on a Smith & Wesson M-66.



Use a frame wrench and remove your barrel properly. A hammer handle through the frame opening can bend the frame.



This Smith M-66 is all set to get a new barrel, or have this one set back.



You don't need the barrel retaining pin, but the revolver does look a bit odd without it.



The Brownells set-back fixture, with cutter and pilots.



Rotate the barrel against the shoulder set-back cutter to remove steel from the barrel shoulder.

Older Smith & Wesson revolvers have a locking pin in the frame's front, above the barrel. You must remove the pin before you can remove the barrel. Start with a small tapered punch to get the pin started without marring the frame, then switch to a longer one to drive it out. Newer revolvers do not have this pin, and the older ones probably never needed it. They do look a little strange without it though.

Clamp the barrel in your padded vise, muzzle down, and slide the frame wrench onto the frame. Lock it in place. Unscrew counterclockwise.

Once you have unscrewed your old barrel you can gauge its "crush fit." Remove the frame from the fixture and the barrel from the vise. Hand screw the old barrel back in until it stops. Your ink line will be split into two lines, 45°. (or 1/8th turn) apart. Once you have properly set the shoulder back the barrel will hand screw in to this same position. The final 1/8 turn will squeeze the threads to lock up the barrel tight in the frame.

The 45° crush is important. You must be patient and get it right. If you set back the shoulder too much and can hand-tighten the barrel this last 1/8th turn, the vibrations of shooting will loosen the barrel. If you set back the barrel too little you may over torque it and crack the frame.

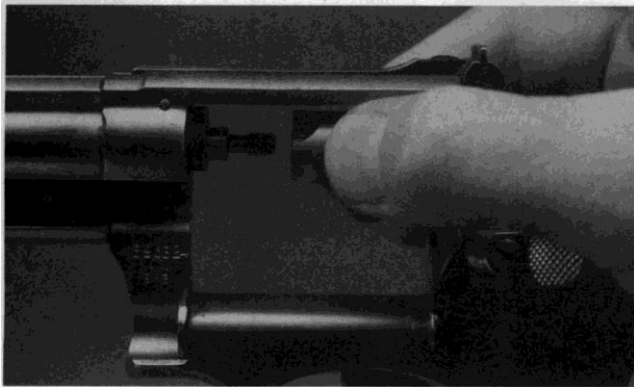
Depending on the amount of worn barrel you have to remove the barrel shoulder will be turned back the distance of a thread or two.

Clamp the shoulder cutter in the vise and install the correct pilot for your caliber. Put a couple of drops of cutting oil onto the cutting edge. Take the barrel, press it over the pilot, and turn it once against the cutter. Remove the barrel from the pilot and screw it into the frame. Repeat the cutting and checking until your barrel turns one full rotation farther into the frame than it did when you first hand-tightened it. You want it to stop at the same 45° (1/8th turn) point as before, but one full rotation farther into the frame. This is your new pre-torque point. Barrels with an underlug enclosing the ejector rod may require filing of the underlug to clear the frame. The barrel setback tool cannot cut the underlug.

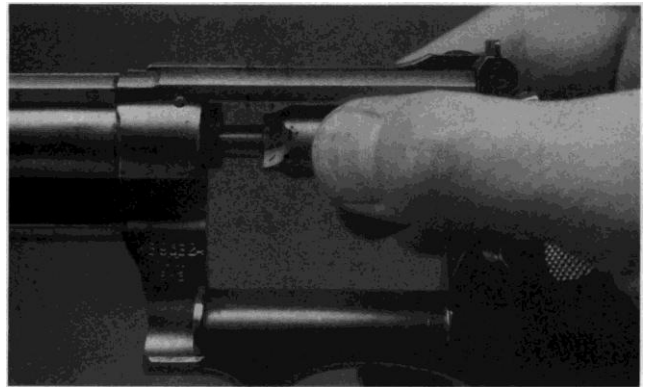
Install the frame wrench. Re-clamp the barrel in your vise. Tighten the barrel all the way to vertical—back to your original pen mark, and remove the frame wrench. Unclamp the barrel.

Your next step is to trim the back of the barrel for cylinder clearance. You will also re-cut the forcing cone. Neither of these can be done with the frame wrench attached. Clamp the grip straps of the frame in the vise.

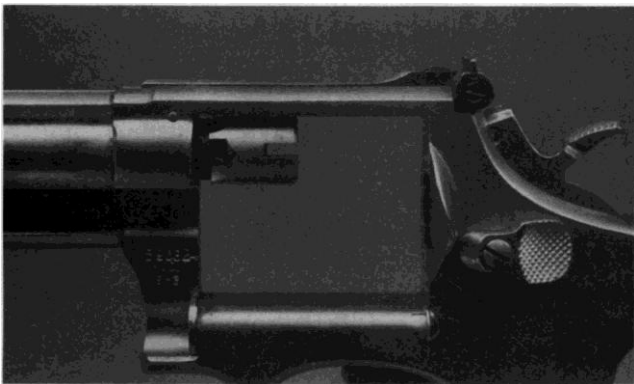
Measure the distance from the rear of the frame opening to the rear of the barrel. It will be less than your barrel zero figure. Slide the barrel squaring rod through the barrel and install the cutter. Cut the rear of the barrel one turn of the rod. Remove the rod and measure the barrel zero gap. Repeat cutting and measuring until your measurement indicates you are at the recorded barrel zero you calculated at the start.



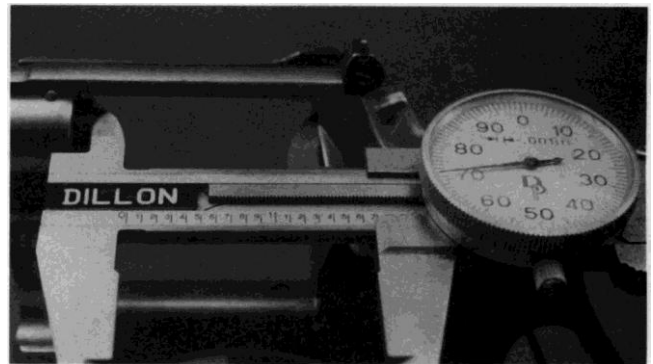
Install the cutter on the shaft.



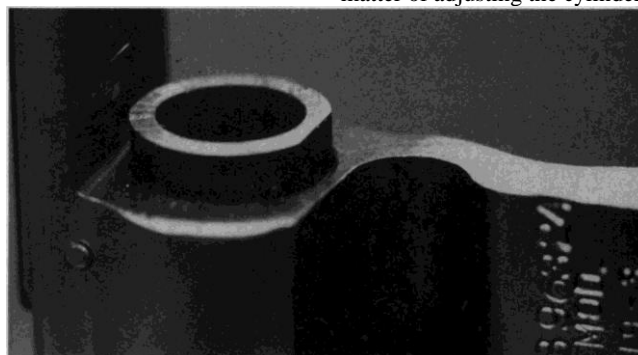
Tighten the cutter on the shaft.



Use the facing cutter to set back the rear of the barrel.



The barrel has been trimmed to its barrel zero measurement. Now it is a matter of adjusting the cylinder gap.

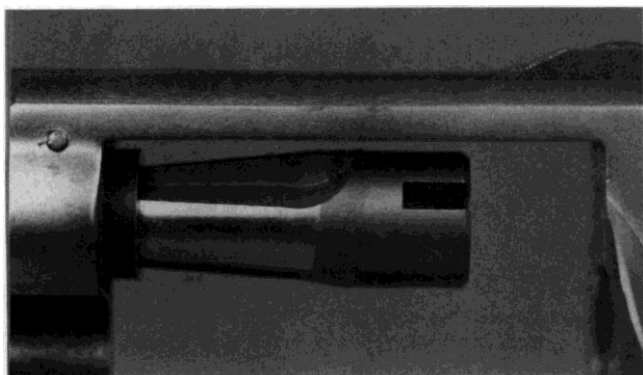


The gap is set, but this dark and pitted forcing cone has to be re-cut.

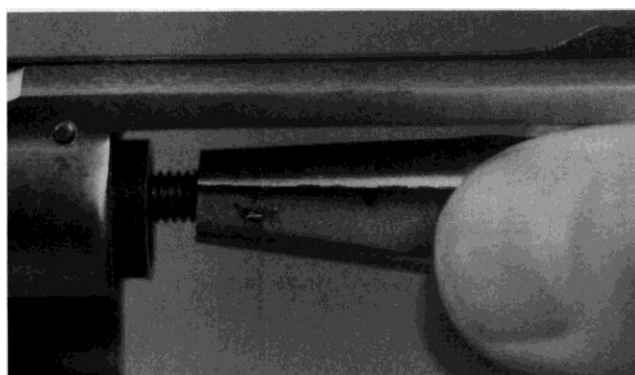
Although you should now be able to close the cylinder, you cannot shoot the revolver with zero cylinder gap. Powder residues will quickly bind the cylinder. Continue cutting the barrel and measuring the cylinder gap with your feeler gauges until you reach .003 inches.

With the barrel gap set at .003 inches you now must re-cut the forcing cone. Master Pistolsmith Ron Power has experimented extensively and found that wadcutter bullets give the best accuracy with an 11° angle forcing cone. For round nose, semi-wadcutters and jacketed bullets Brownells suggests an angle of 18°. Brownells offers forcing cone cutters in both of these angles.

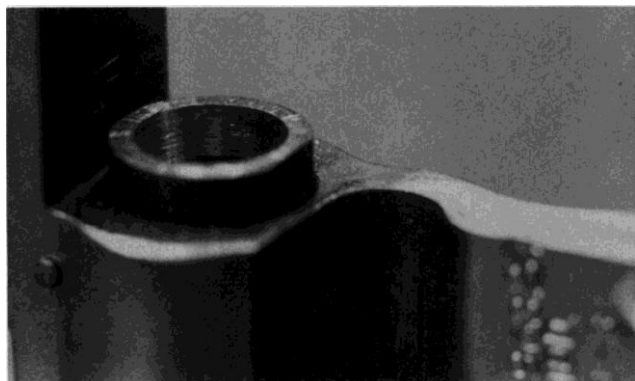
Replace the rod in the barrel and install the forcing cone cutter of your choice. Give the cutter two turns, and take it off the rod. Not all of the forcing cone will have been cut. Check to see how much metal two turns removed, and estimate the additional turns you will need. Repeat until the forcing cone has been fully cut. Use the forcing cone gauge to check the cone opening. Be patient and cut to the correct size. Stop when you have the gauge sitting correctly in the forcing cone.



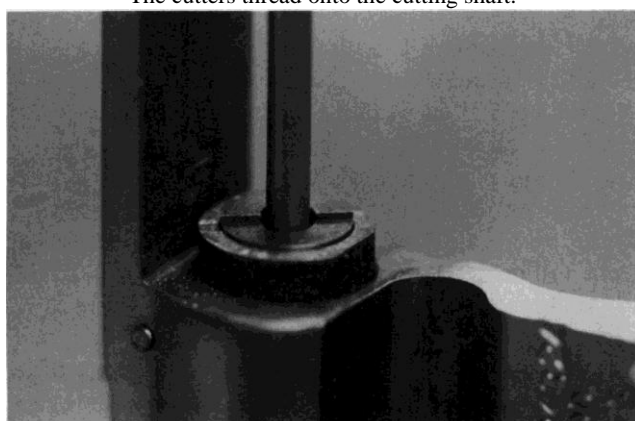
This is an 11° forcing cone reamer.



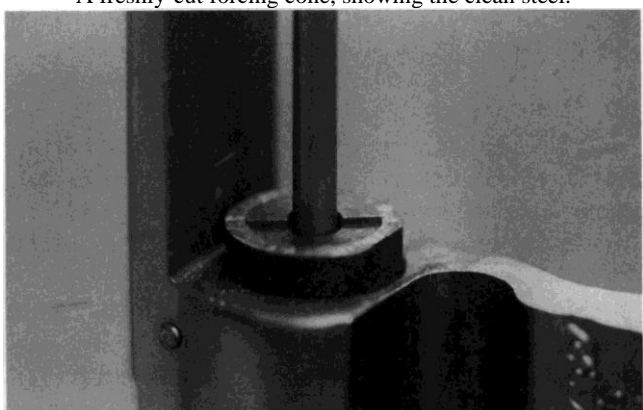
The cutters thread onto the cutting shaft.



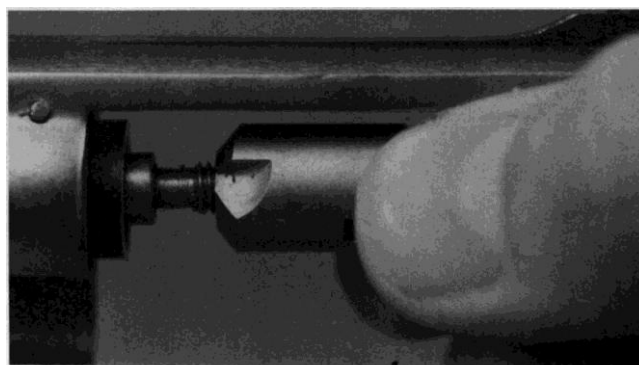
A freshly-cut forcing cone, showing the clean steel.



This forcing cone needs more cutting.



The forcing cone gauge shows that this forcing cone has been cut just right. If the upper shelf is in the cone, too much has been removed. If the lower shelf is not in the forcing cone, the cone is not deep enough.



The 82° cutter breaks the edge of the freshly-cut forcing cone, removing any burrs that might be present.

Take the 82 degree edging cutter and run it once around the forcing cone, just to break the edge.

Your set-back barrel may now be a little too short to clear the tip of the ejector rod. Check by installing the rod in the cylinder without fully tightening it. Try closing the cylinder. If the tip of the ejector rod no longer clears the shoulder of the front locking bolt file the ejector rod down until it clears. While you're at it, check the centerpin. If it's too long, shorten it.

Before you replace the barrel retaining pin you must go to the range and test fire your revolver. When you re-tightened the barrel you should have come very close to or been on your witness mark. Test fire to see if you have to make any minor adjustments of the barrel rotation to return your groups to dead-on. We covered the process of adjusting a fixed-sight revolver in Chapter 13. Use the fixed-sight adjustment process even if your revolver has adjustable sights. When your adjustments have the groups dead-center, drift the retaining pin back in place.

Your revolver is good for another long series of magnum loads.

Replacing the barrel—factory replacement

Sometimes a barrel is beyond repair and you must replace it. If the old barrel is so worn that it must be set back four threads or more, if it has already been set back once or twice, if it is cracked in the rear, if neglect has left its bore pitted—you are best off replacing it. Or you may just want a different barrel.

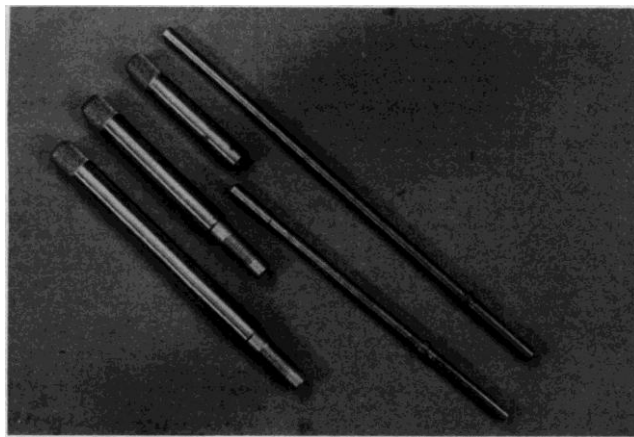
If you are replacing the old barrel with a new factory barrel you will follow essentially the same procedure as you did in setting the old barrel back. If you are switching from a four-inch barrel to something shorter, you may also want to replace the ejector rod and center pin. Snub-nose barrels all use much shorter components. While you can shorten the existing ones it is much easier to purchase the appropriate ejector rod and center pin when purchasing your shorter barrel.

Measure and record your barrel zero. Unscrew the old barrel and set it aside. Screw on the new barrel by hand. If it stops 1/8th of a turn short of vertical, (the pre-torque point) you are in the catbird seat. Measure the frame to barrel gap. If it is equal to or less than your barrel zero, tighten the barrel. If it is greater, you must set the shoulder back.

If the barrel does not reach, or rotates past, the pre-torque point you will have to set back the shoulder until it stops correctly. Once you have torqued the barrel in place cut the rear barrel face and forcing cone to set the new barrel to the correct cylinder gap.

Reinstall the old ejector rod and center pin and check them for fit. On a snub-nose barrel install the new rod and pin.

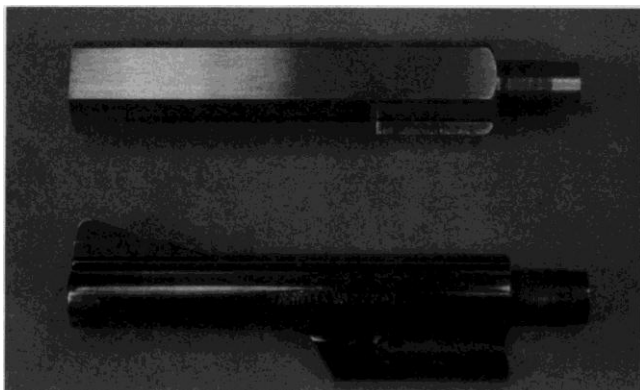
Test fire to make your minor adjustments to zero the barrel, and you are done.



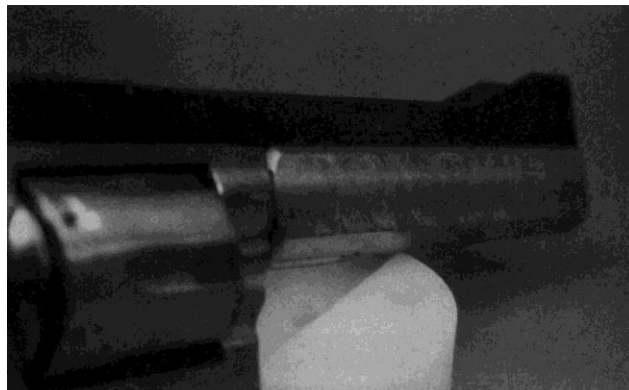
Snub-nose barrels use shorter ejector rods and centerpins. Keep this in mind if you change a four — or six-inch barrel to a two-inch one. Rather than shortening the old ejector rod and centerpin, buy new ones.

Replacing the barrel—a bull barrel

When shooting in matches like the National Police Championships, where triumph can be measured by one or two points out of close to 1,600 possible; and the NRA Bianchi Cup, where only a perfect score will guarantee a chance at the win, competitors cannot afford to give up a single point because of their equipment. Even a very accurate factory barrel will not be good enough here. For a competition barrel look to one of the big three: Clark, Power, and Barnett.



Replacing a worn factory barrel with a new match barrel can increase accuracy dramatically. The bull barrel will not have a front locking mechanism.



This bull barrel has been “slabbed.” The round barrel has been machined flat on the sides.

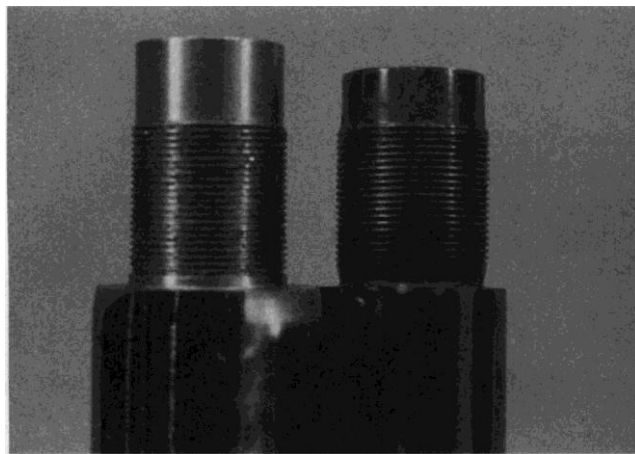
Installing a competition, or “bull” barrel requires the usual barrel fitting equipment plus some special tools and parts. With a bull barrel you must deal with the pressure ring on the frame from the old barrel, provide a means of locking the front of the crane, and install new sights.

Bull barrels and the pressure ring

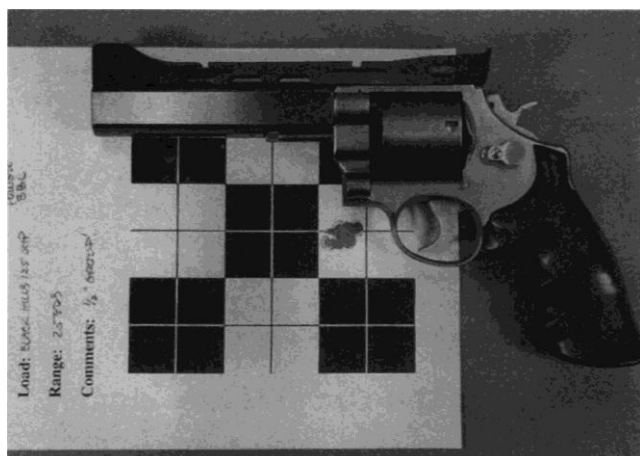
Regular S&W barrels measure .795 to .805 inches in diameter. Bull barrels are larger across, ranging from 1 to 1.125 inches. Their increased diameter makes them heavy, which means more work for you when installing them.

Torquing a barrel into place pushes up a pressure ring on the front of the frame. This pressure ring does not get in the way of setting the old barrel back, or replacing it with another barrel of the same diameter. The larger diameter barrel, however, will touch the pressure ring before it can tighten against the frame. This contact can microscopically tilt, or unevenly stress the barrel. As the revolver heats up from shooting, the tilted or stressed barrel may become inaccurate. Since the whole point of the new barrel is the utmost in accuracy, this pressure molehill assumes the proportions of a mountain. It must be removed.

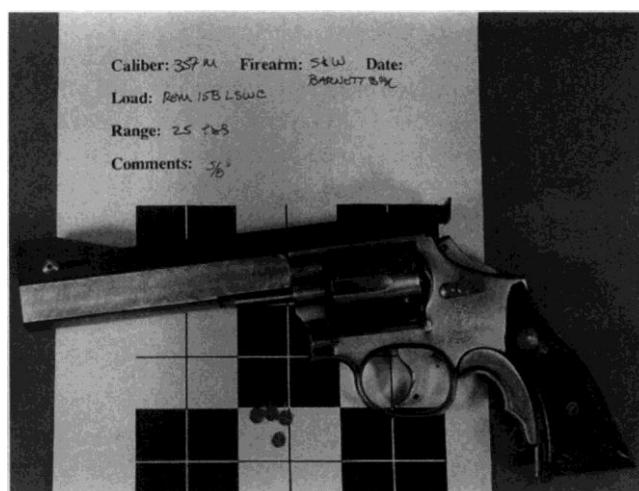
After unscrewing the old barrel Dykem the front of the frame. Let the Dykem help you with this delicate piece of work. Proceed carefully with your pillar file, using gentle strokes to remove the pressure ring without changing the barrel seat. If you tilt the seat the barrel will not tighten evenly.



A bull barrel will have a larger shoulder than the factory barrel. You will have to remove the pressure ring from the frame for the new barrel to fit properly.



This Smith & Wesson M-27 with a Power bull barrel and rib, shoots full-power .357 magnum ammunition as accurately as a Bull's eye gun.



This is a good group, but not spectacular. The reason is, the forcing cone is cut to 11°, for wadcutter bullets. Feeding it semi-wadcutter bullets isn't fair. Still, just over half an inch at 25 yards is plenty good.

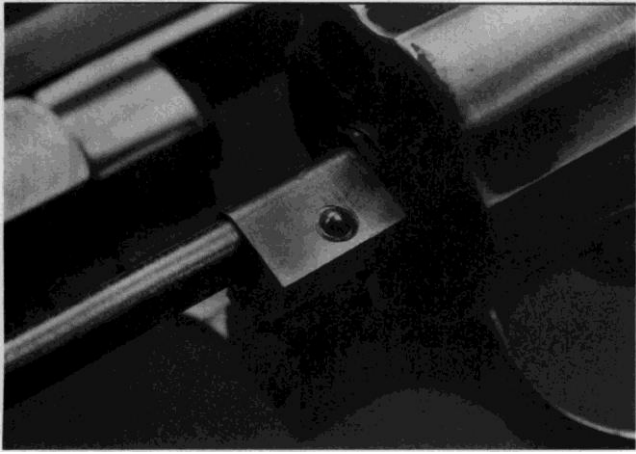
Once the ring is gone, apply Dykem again and screw in the bull barrel by hand. Check to see that the barrel tightens to the 1/8th turn point as before, and that it contacts the frame evenly. Uneven contact will show up as uneven rubbing of the Dykem. If the barrel contacts unevenly but is almost to the 1/8th-turn point, use a medium-fine stone to dress down the tool marks that are **first contacting the frame**.

If the barrel is more than 1/4-turn short of the 1/8th point, or turns past that point, use the barrel set back tool to remove some of the barrel shoulder until it will stop by hand at the 1/8th point.

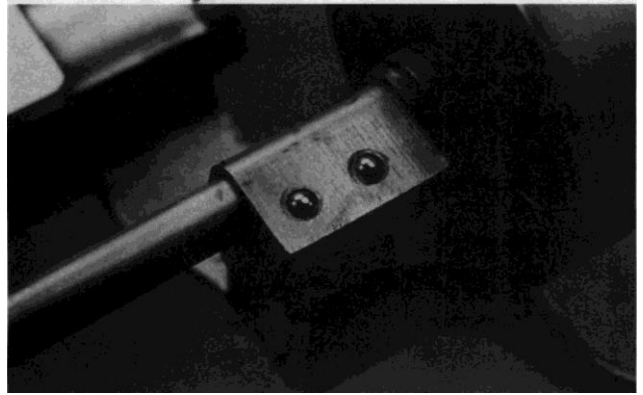
Once the barrel is in full contact and turns by hand to the 1/8th-turn point, **tighten** it with the frame wrench. Adjust the cylinder gap and forcing cone as above. If your revolver will see only wadcutter bullets cut the forcing cone to 11°. If you will be using it for NRA Action shooting or the Bianchi Cup and you will be loading other style bullets cut the forcing cone to 18°.

Crane lockup

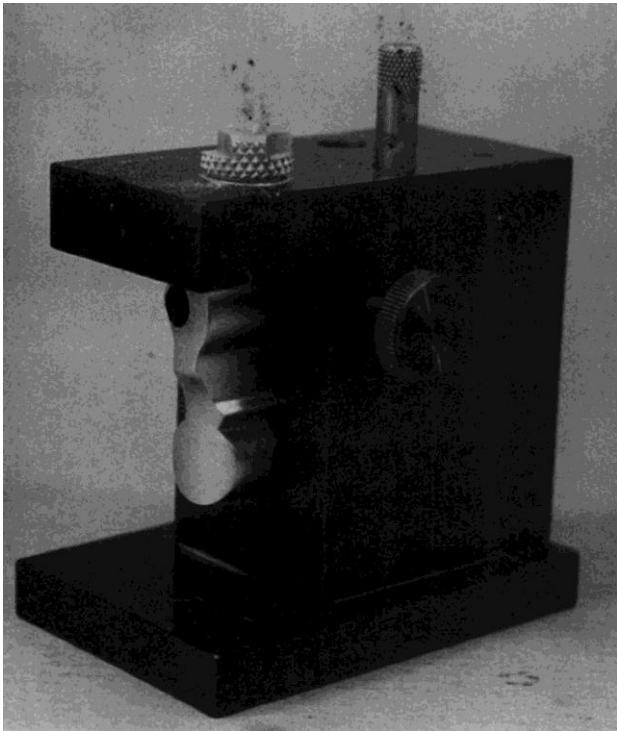
Your factory S&W barrel came with a front lockup. Since bull barrels do not, the crane must be locked in place mechanically. Commonly, one or two spring-loaded ball bearings are placed in the crane, riding against the inside of the frame and under the barrel. You must have a locating fixture to drill the holes in the crane and secure the ball bearings. I have used one from Maryland Gun Works for years. To allow the balls purchase against the frame, you must drill small dimples in the frame, under the barrel.



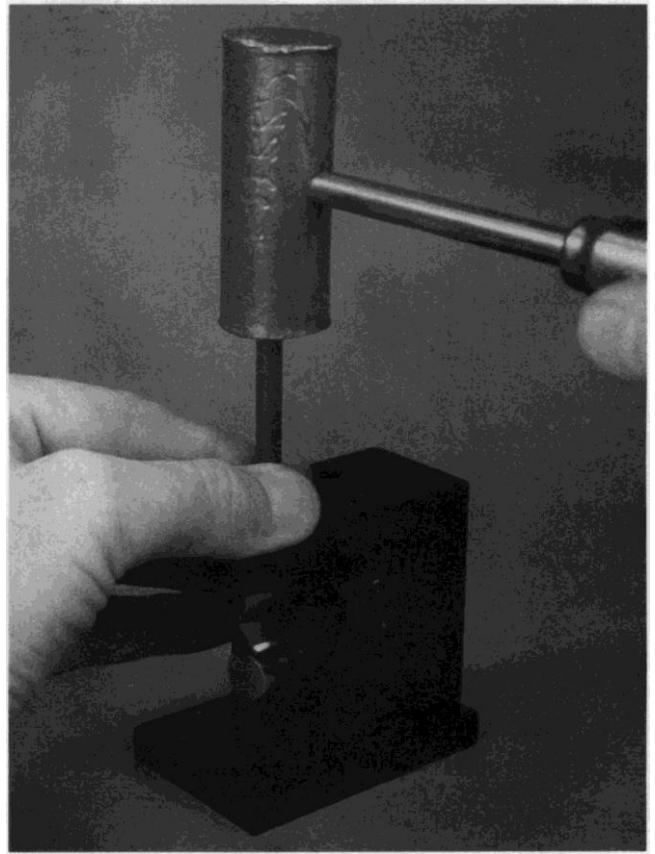
A single ball bearing is enough to hold the crane closed.



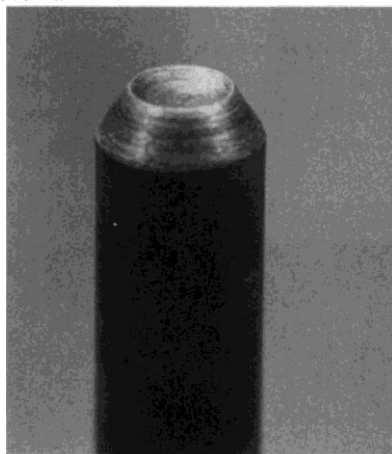
These balls lock into the dimples.



The crane In place, with the drill guide over it.



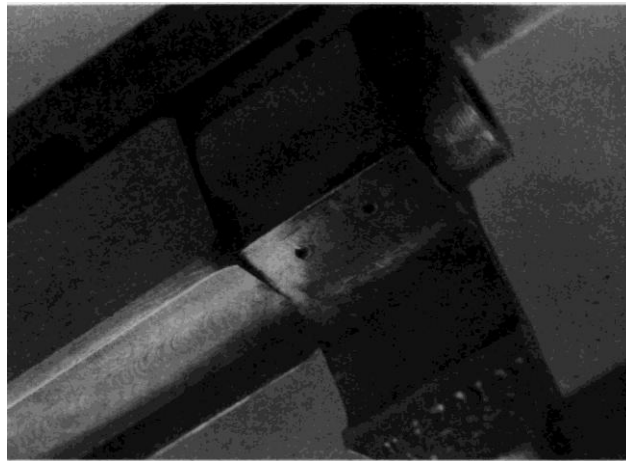
The ball being staked.



This is the tip of the detent ball staking tool. It holds the ball in place while peening the edge of the hole.

Position the crane in the fixture. Drill the hole or holes. Place a drop of lubricant into the hole, insert the spring and the ball bearing. Place the staking rod on the ball and give it a tap. If you do not strike hard enough the ball will not be held in. If you strike too hard the ball will be locked down too far and not press against the frame. Since you can always strike again harder, start with light taps and build up in force, checking between hits.

Once the ball is locked in place, put Dykem on the upper inside of the frame cutout, under the barrel. Open and close the crane several times, until you see a line in the Dykem. Take your centerpunch and mark the frame at the end of the line or lines. With a three-inch long drill 1/8 inch in diameter, make a small dimple at the center-punched locations. You want only enough of a divot to hold the crane. If the divot is too small the crane will not be locked. Drill too much and the crane will be loosely held.



The frame under the barrel has been dimpled to hold the crane closed.

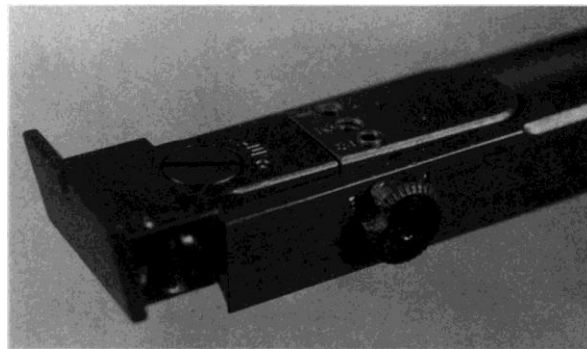
Sights

Bull barrels do not come with sights; you must install them yourself. Just as the barrels are precise, the sights must be precisely adjustable.

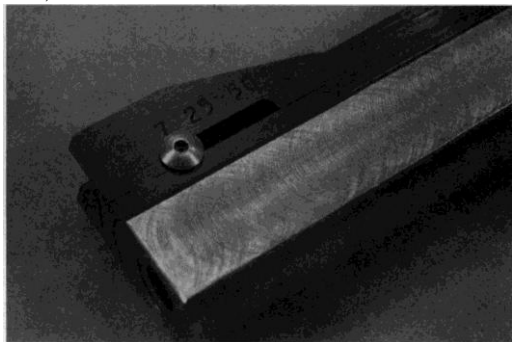
Most gunsmiths drill and tap the barrel and install a sight rib. Available from Aristocrat and Ron Power, the sight rib is a single bar containing both front and rear sights. Ribs commonly offer quickly-adjustable specific sight settings and are useful in competitions with fixed firing distances. The Aristocrat Custom has a sliding button on the front left side that allows the shooter to select from three settings. The Power Double Grand Master has four settings in the rear. By moving a knurled wheel you can quickly set the rear sight for one of four different distances.



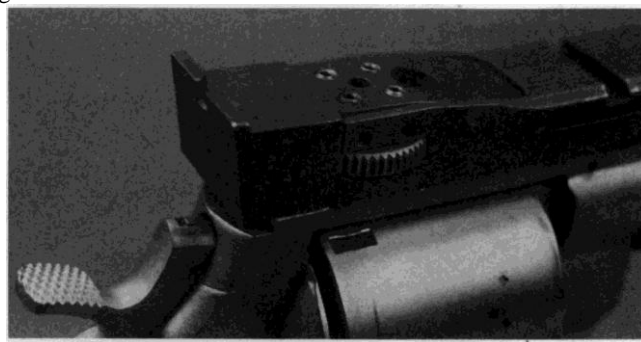
This Smith & Wesson is a tack-driver, with a slicked-up trigger pull, Barnett barrel, Aristocrat rib and wad-cutter bullets.



This Aristocrat sight rib has an adjustment button for quick-setting the sight to different distances.



This Aristocrat rib uses a sliding button on the front to set the sight for 7, 25 and 50 yards.



The Power rib has four settings for the rear sight.



The Power rib is scalloped on the front to clear the ports of Mag-na-Porting.

Bo-Mar also makes revolver ribs. Their design, however, fits over the standard barrel, not a bull barrel.

Ron Power offers some of his barrels drilled and tapped for his rib. If you want to install the Aristocrat rib you will have to drill and tap your barrel. You will need the correct size drill and tap for the rib screws, and a hole-centering locating punch.

Take the rib and center it on the top of the barrel. Make sure it is flush with the muzzle. With a piece of masking tape attach it to the top of the barrel. Hold the revolver up in your firing position, and look at the rib. Are the sights vertical? If the rib doesn't look right, it isn't. Adjust the rib and tape it again. Once the rib is vertical, mark the rib holes for drilling and tapping.

If you have used a Ron Power barrel that is already drilled and tapped, use one screw to hold the rib in place while you check its vertical alignment. If the rib is not straight up and down, you must adjust by turning the barrel.

On the untapped barrel, after you have marked your hole locations, use a #31 drill and a 6-48 tap. The holes do not have to be more than .150 inches deep.

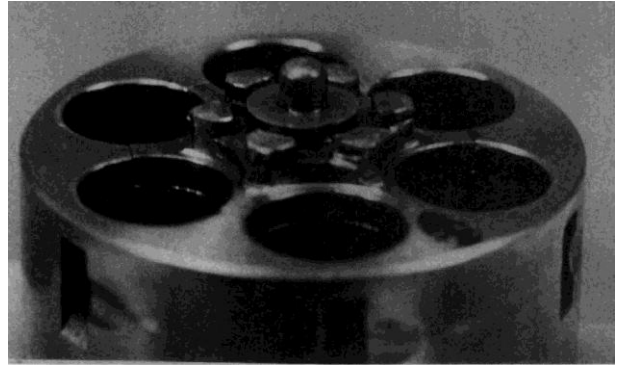
Install the rib and tighten the screws. Your bull barrel is ready for shooting.

Chamfering the chambers

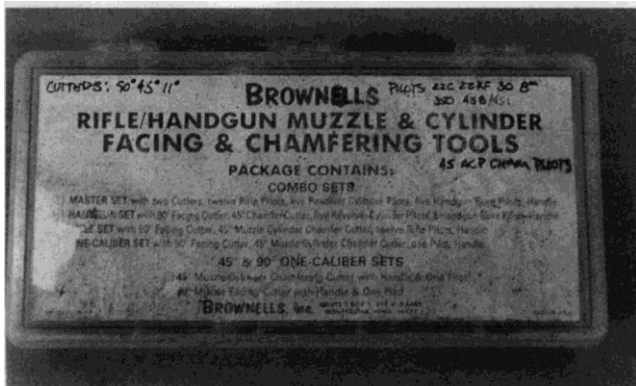
In many types of competitive shooting reloading must be done quickly. A second or two lost in reloading is that much less time available for shooting a disappearing target.

To speed reloading, the edges of the chambers are beveled, or chamfered.

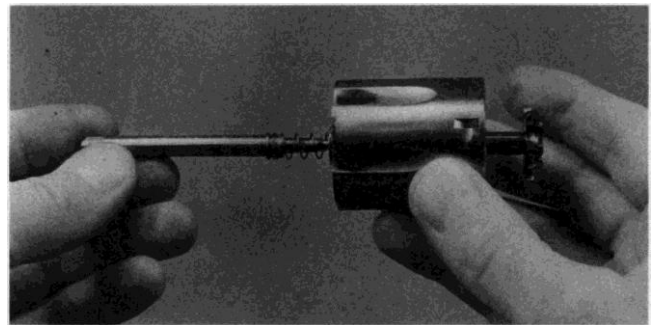
While chamfering can be done with files, stones, and a steady hand the easier and less hazardous method is to use Brownells chamfering kit. You can get one caliber-specific to your revolver, or the larger kit which can do all calibers.



This cylinder is unchamfered.



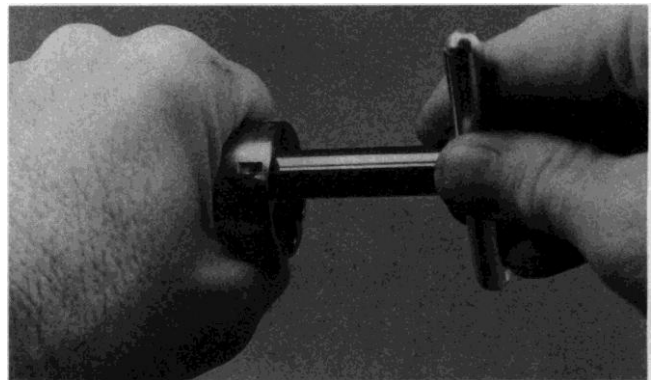
Use the Brownells chamfering kit.



To chamfer your chambers, remove the extractor star.



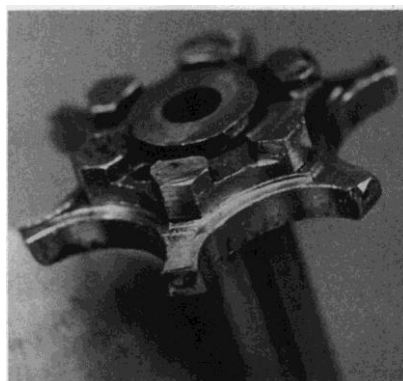
Put the correct pilot for your caliber on the cutting tool, and insert the whole thing into the chamber.



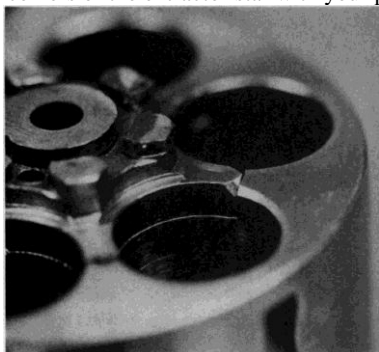
Turn the handle a couple of times and remove it. Check to see how much you've cut. Repeat if necessary. Go on to the next chamber.



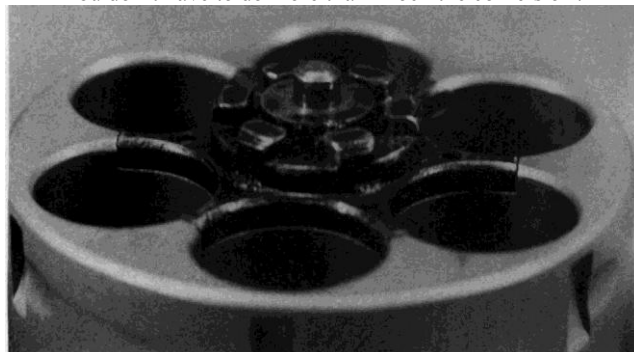
Bevel the comers of the extractor star with your pillar file.



You don't have to do more than knock the corners off.



The beveled corner of the extractor star will blend with the chamfered chamber mouth.



This cylinder is chambered in .45ACP and has the extractor chamfered. Only do this to a .45 ACP revolver. On any other, the chamfered extractor may slip off the cartridge rim and cause a malfunction.

Remove and disassemble the cylinder. It is important that you remove the extractor star before chamfering. If you chamfer it your empties will not be held as firmly by the extractor. In such a situation an empty can slide off, and then under, the extractor before being ejected. It is difficult to remove an empty so positioned.

With the extractor star out clamp the cylinder in your padded vise. Insert the correct caliber pilot into the chamfering tool. Put a few drops of cutting oil on the teeth of the tool and slide it to the back of each chamber. Take two turns, pull the tool out and look at the edge of the chamber. You want to bevel the edge and no more. After the chambers are chamfered use an extra-fine round stone to curve the edges of your cuts.

Before reinstalling the extractor, use your pillar file to bevel the outside corners of each arm. The bevel keeps the extractor tips from forming a corner at the end of your chamfered edges.

Reassemble.

Barrel underlug

While more weight is better, for some shooters too much is not enough. They want even more. The logical place for it is under the barrel. Getting an underlug straight is not nearly as critical as getting a sight rib straight. Just turn the revolver over and use the frame as a guide to lining up the rib. Drill and tap the bottom of the barrel and install the underlug.

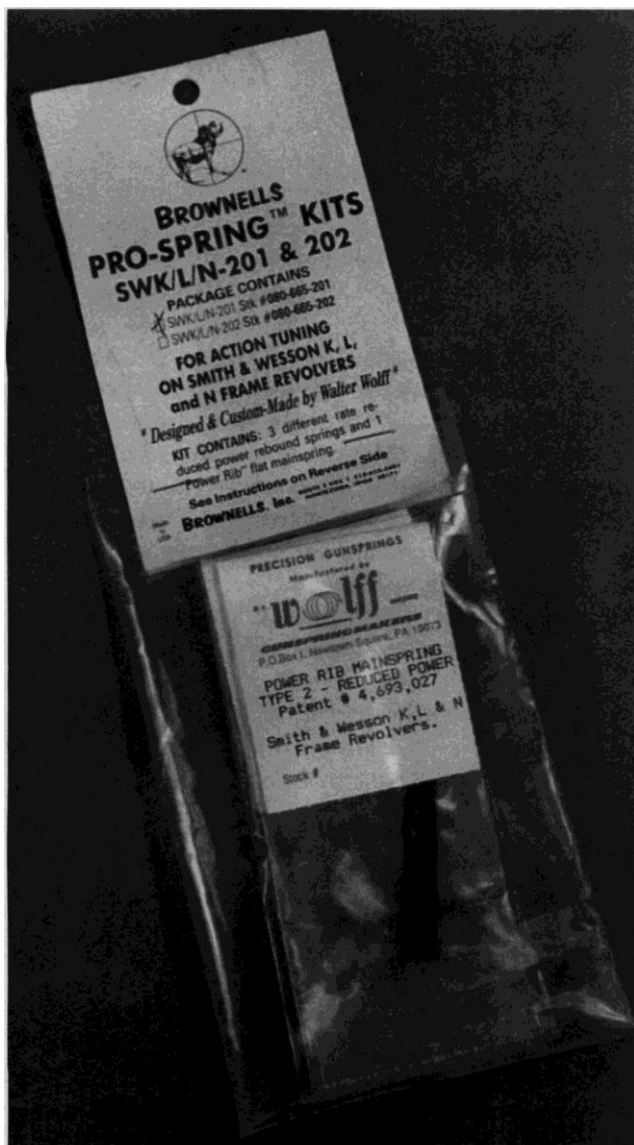
Full-house trigger job

It would be nice if all it took for a mighty improvement in shooting accuracy was a new, accurate, match barrel. Unfortunately for most of us, it is only the rare revolver shooter (the great Jerry Miculek springs to mind) who can get by with a match barrel and a standard trigger job. The rest of us need some additional help.



For even more weight, add a barrel underlug.

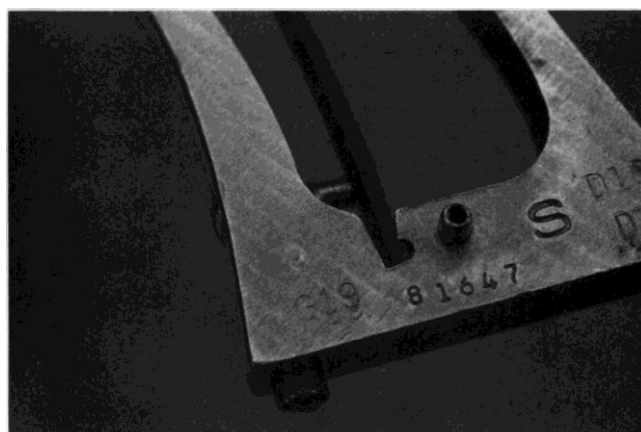
Disassemble the action parts. If you have already done an action job, set the trigger parts aside. If not, go back to Chapter 15 and follow the instructions.



Wolff makes a spring kit to improve your trigger pull. You can get it from Brownells.



The hammer spur should be removed to improve trigger pull. Leave the shoulder at the bottom of the spur, to prevent the hammer from over-rotating.



Here is the locking screw (bottom), keeping the strain screw from backing out.

For your new work you will need a spring kit from Wolff. The kit comes with your choice of a standard-power or a reduced-power mainspring and three rebound springs, with weights of 15, 14, and 13 pounds. The Wolff mainspring in the kit offers smoother compression than standard mainsprings. Use the standard-power spring if you will be shooting magnum ammunition, or reloading with magnum primers. For standard ammunition or primers use the reduced-power spring.

To obtain the lightest trigger pull you must remove the hammer spur for faster lock time. Clamp the hammer in your vise with the spur pointed out. Put a cutoff wheel in your hand held grinder. Cut through the base of the spur on top and the sides. On the bottom of the spur, do not cut right at the radius of the lower arc. The bottom of this shoulder, which prevents the hammer from over-rotating and misaligning the action parts, must be left intact. When you cut through, remove and discard the spur. With the spur gone you have to make the hammer more attractive, and less like something Dr. Frankenstein would shoot. Move the hammer in the vise so the area you have just cut off is horizontal. Use grinding stones to polish the cut area smooth.

Since you will be adjusting the mainspring you need some way to lock in your adjustment with the mainspring strain screw. If you simply adjust the spring by backing out the screw, the vibrations of shooting will loosen it. At some point you will start to experience misfires. Instead, remove the strain screw. Drill through the bottom of the frame drill to the strain screw hole. Use a #31 drill and tap the hole 6-48. Replace the strain screw. Install a 6-48 screw in the new hole that is long enough to reach the strain screw. You now have a locking screw.

Reassemble the revolver to test fire your spring tension. At the range, start with the strain screw fully tightened. Gradually loosen it, reducing spring tension until you begin to experience misfires. Now tighten the strain screw, increasing the spring tension until your rounds all fire. Add a quarter-turn more to the strain screw, and mark the location. Tighten the locking screw to hold the strain screw in position.

Trigger pull is a matter of feel and speed. What works best varies from shooter to shooter. If a heavy rebound spring with a light mainspring feels awkward, install a lighter rebound spring. A 13 pound rebound spring doesn't work for me in fast double-action shooting, so my bowling pin, IPSC/USPSA and IRC revolvers all have heavier rebound springs. In the slower pace of PPC competition, I use the thirteen pound spring without problem. You will have to experiment to see if what works best for your practice or competition.

Cylinder & Slide roller action

In the standard revolver design the hammer and trigger slide against each other. To make the action even smoother, Bill Laughridge of Cylinder & Slide designed a hammer with a roller bearing located on the tip of the double-action sear. To fit the roller bearing, Bill re-designed the trigger.

The C&S kit is a double-action only mechanism. You will not be able to thumb-cock the hammer. The spur is only for holsters with a thumb strap.

The two parts start life as standard Smith & Wesson issue. Bill re-grinds the trigger so its curvature is better suited to the roller-action DA sear. He modifies the hammer to take the precision-ground DA sear and its roller tip.

To install, remove the factory hammer, trigger and rebound block. Set them aside. Take the hand from the factory trigger and install it on the C&S trigger. Install the C&S trigger and the factory rebound block with its spring. Observe the trigger function. It should pull the locking bolt down and release it cleanly.

Install the cylinder. Check that the trigger advances and locks up the cylinder each time you work it. If the front of the trigger is late in releasing the cylinder locking bolt, the cylinder will rotate past locking. Do not adjust the cylinder locking bolt or the revolver will have problems when you reinstall the old trigger. Instead, adjust the trigger. Use a medium fine stone across the front of the trigger. Keep the stone at the original angle of the trigger face. You will need to shorten the face only a few thousandths.

If the cylinder won't rotate, the cylinder locking bolt is being pulled down too little or too late. Which is to say, the hand is pushing on the cylinder before it is unlocked. You must adjust the hand. Stone the top of the hand, shortening it only a few thousandths. Stone the tip for a few strokes. Try the fit. Repeat until the cylinder will advance. The shortened hand will still work with the old hammer and trigger.

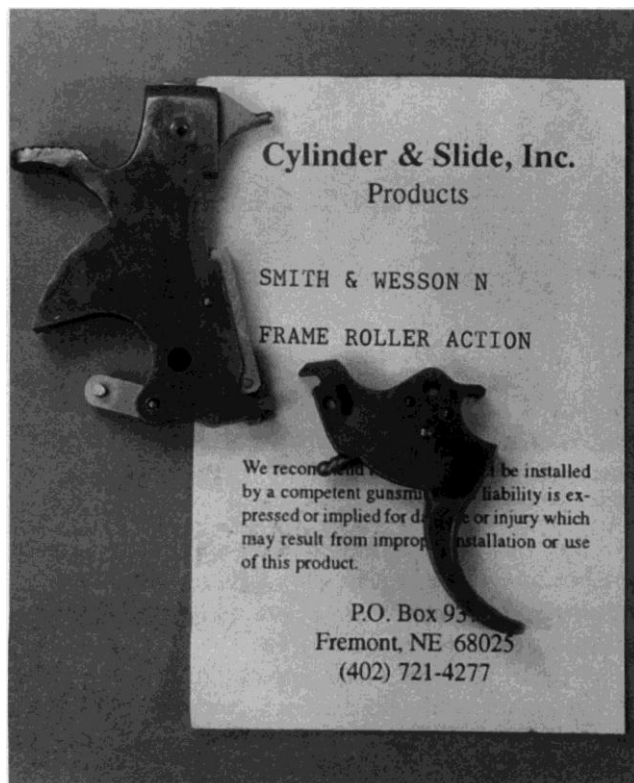
Install the hammer. During manufacture Bill sets the DA sear "short," that is too close to the hammer. You must adjust it for your revolver. Drive out the sear retaining pin and file on the shoulder marked with red ink. Reinstall and check the fit. Correctly adjusted, the DA sear will spring back into position when the trigger returns to rest. There will be only .005 to .010 inches of gap between trigger and sear when both are at rest.

Place some McCormick Trigger Job on the roller bearing, and in the hammer pivot hole. Your double-action trigger pull will now be smoother than before.

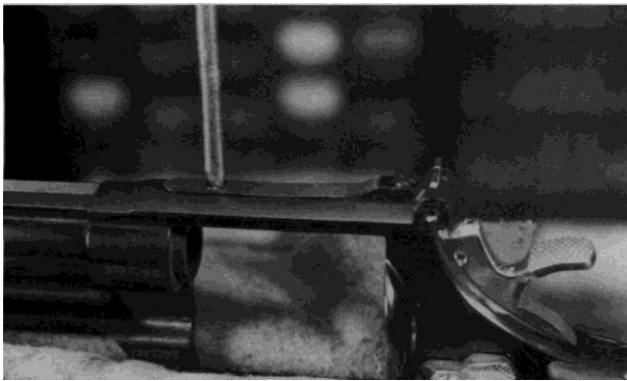
Scope mounting

Current production S&W revolvers are drilled and tapped for a scope mount. If your older S&W revolver is not, you must drill and tap the frame.

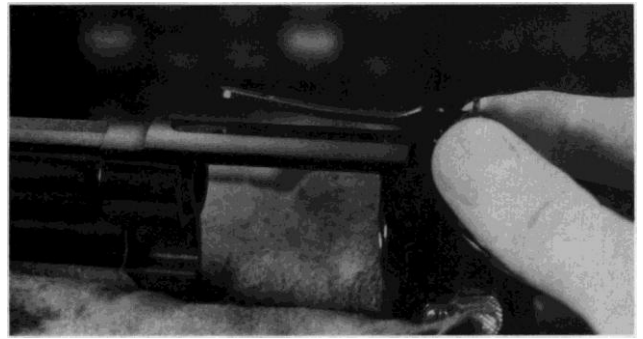
Remove the front screw of the sight assembly and slide it out of the frame. Because the screw is small use a properly-fitting screwdriver. To avoid losing the screw after removal, attach it to the rear sight with a piece of masking tape and store them together. Remove the cylinder and clamp the frame in your padded vise. Slide the scope mount onto the frame and hold it in position while you mark the hole location with a Brownells hole centering punch. Clamp the frame in your drill press and drill with a #31 drill. Tap the holes with a 6-48 tap. De-burr the holes. You are now ready for your scope.



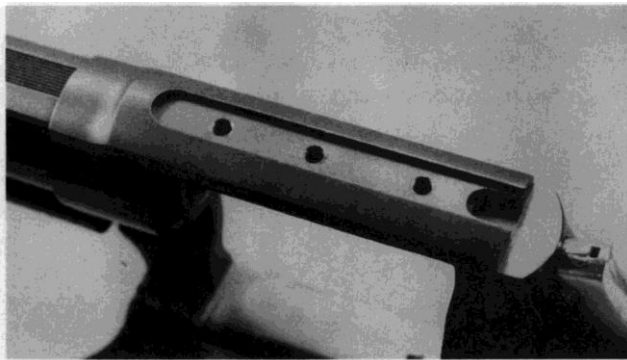
The Cylinder & Slide roller bearing action kit can make your revolver smoother than ever in double-action shooting.



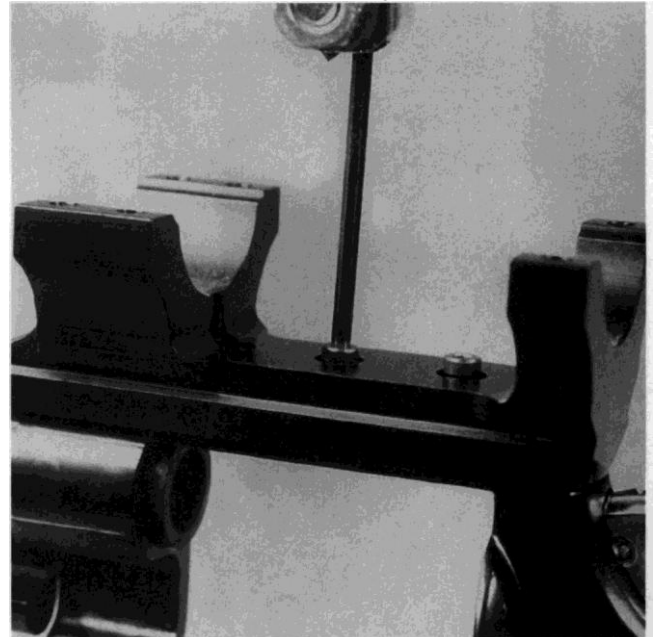
The front screw holds the sight on.



With the screw removed, slide the sight back out of the frame.



Here are the three scope mount holes, drilled and tapped at the factory.



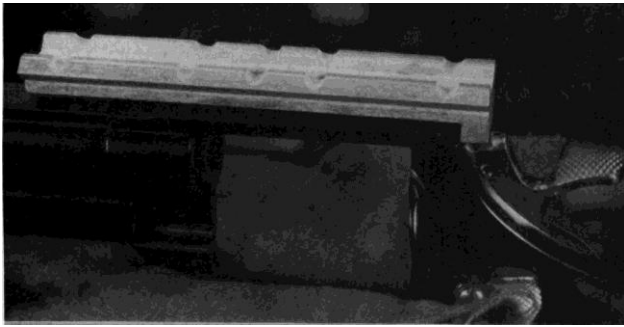
The Weigand rings have the ring lowers integrally milled into the base.

There are three steps to mounting a scope: base installation, ring set-up, and scope clamping. Intermingled with both the second and third step is the task of aligning the scope to the bore of the revolver. The internal adjustments in a scope can only move the crosshairs so far. A scope pointed too far from the bullet's impact cannot be adjusted internally.

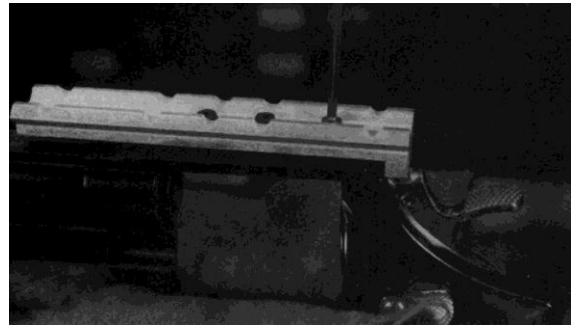
To align the scope you have three choices. Your first and best choice is to use a bore collimator, which will allow you to bore-sight the scope before you have left your shop. If you don't have a bore collimator, you can aim at a distant object, a path with one singular problem—can your vise hold your revolver so you can sight it through a window? Unless you live in an auditorium your farthest wall will not be far enough. If your shop is too small for aiming you can go to the range and sight-in the new scope from scratch. The last approach is tiring and has the potential to consume large amounts of ammunition for no results. Sometimes, though, it is the only choice available.

Base installation is the same for all mounts. Line up the holes in the base with the holes in the frame and tighten the screws. Look underneath the top strap to make sure the screws are not protruding into the space for the cylinder. If they are, shorten them. Once you have tightened the screws the first time, go back over them again. The second time, lean on the screwdriver while you turn it. On .44 Magnum revolvers I go through this two or three times, tightening each screw just a bit more each time. If I ever want to remove the screws they will come right out, but they will not come loose during shooting. I do not like to use Loctite on scope bases or rings except in extreme cases. It makes later removal difficult.

Ring set-up differs from brand to brand. The Weigand base has the rings integrally milled, and you can go right to scope clamping. Place the tops of the rings on the scope and tighten the attaching screws.



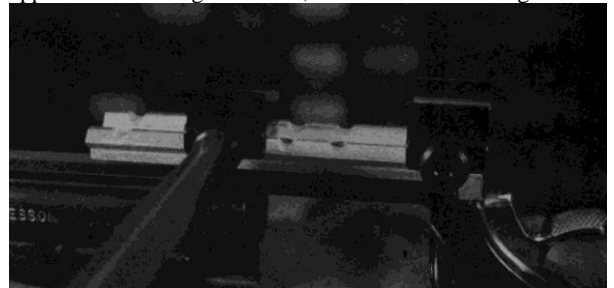
Place the mount on the frame.



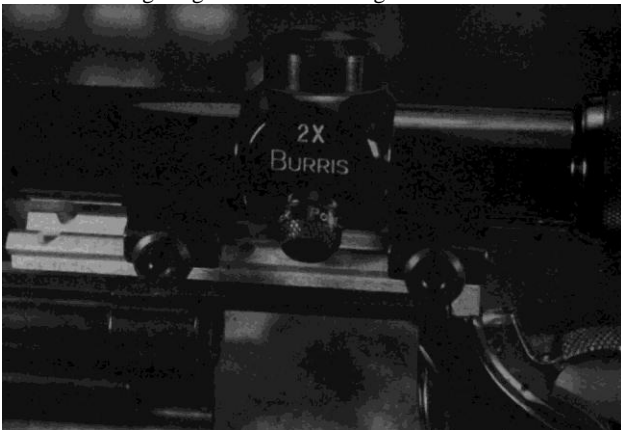
This EGW base for Smith & Wesson revolvers uses three holes drilled and tapped in the rear sight channel, and takes Weaver rings.



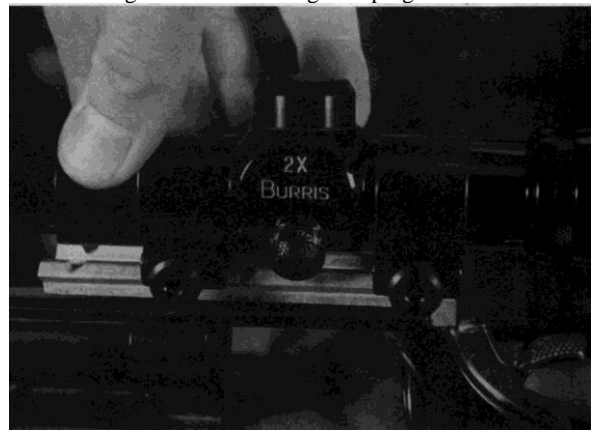
Finger tighten the lower rings on the base.



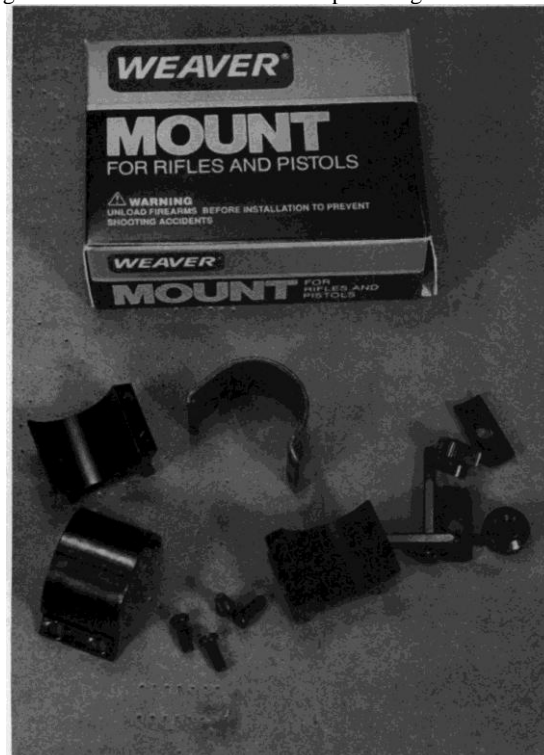
Tighten the lower ring clamping screws.



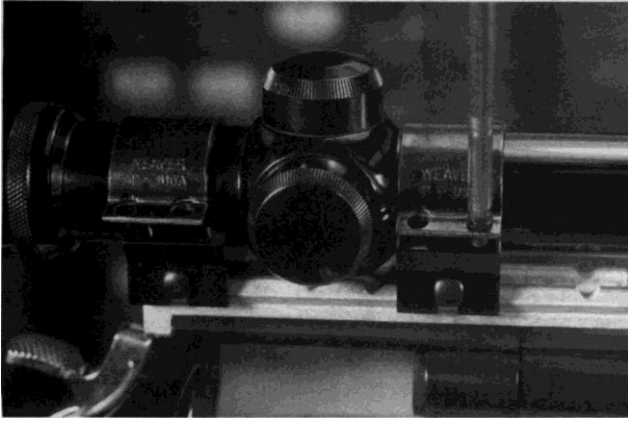
Place the scope on the ring halves.



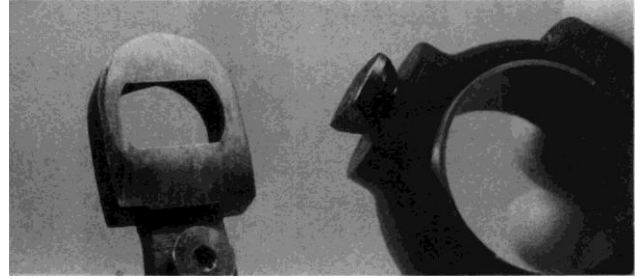
Snap the rings over the scope and slide them over the lower rings ledges.



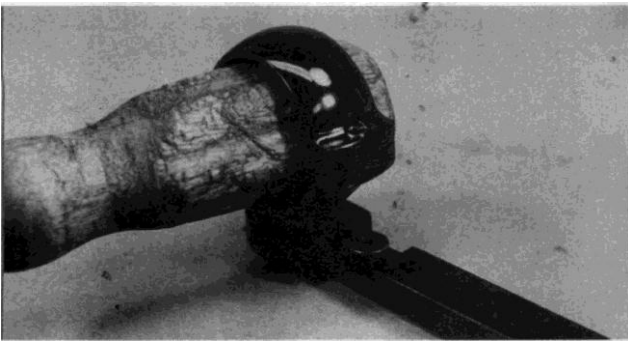
Weaver rings can not be adjusted, only installed.



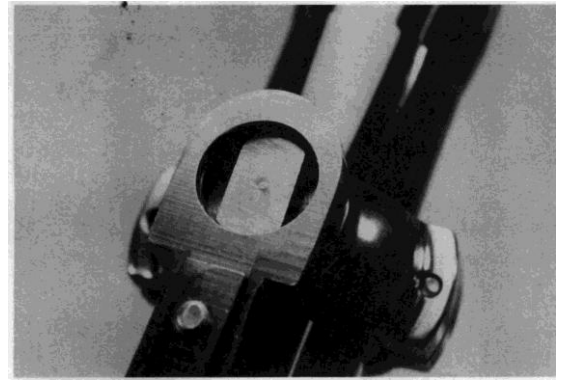
The Weaver rings have screws on only one side. Start with the scope crosshairs slightly tilted, and let the rings tightened up and pull the crosshairs vertical.



The front ring of the Burris mount slides into the slot milled in the base.



Turn the ring with a bar or rod, not the scope.



The lower lug on the ring locks into the base once the ring has been rotated ninety degrees.



Once the Weigand base is secured, place the scope in it and tighten the upper halves.



With a bore collimator, you can get your scope bore-sighted without wasting ammo at the range.



Tighten the rear screws by hand before tightening the scope. Later, you will tighten these screws with a large screwdriver.

The Weaver system has rings and bases which clamp together. No adjustment is possible. Attach the lower part of the rings to the base. Snap the upper rings over the scope and then slide them onto the lower ring with the ledges interlocked. Line up the screw holes and tighten the rings. The rings have locking screws on just one side. As you tighten the screws you will turn the scope slightly in the rings. Because of this, start with the crosshairs tilted slightly away from the screws and let the scope turn to vertical.

Burris, Redfield and Leupold scope rings must be adjusted. Place the front ring into the base. Use a wooden rod or large diameter steel bar to turn the ring a quarter-turn to lock it into the base. Tightening the ring with the scope will break the scope. Center the front ring by eye and remove the top of the ring. Place the scope in the lower half and look at your bore collimator. If the crosshairs are off the collimator grid, remove the scope, replace the upper half of the ring and adjust the ring with the rod or bar.

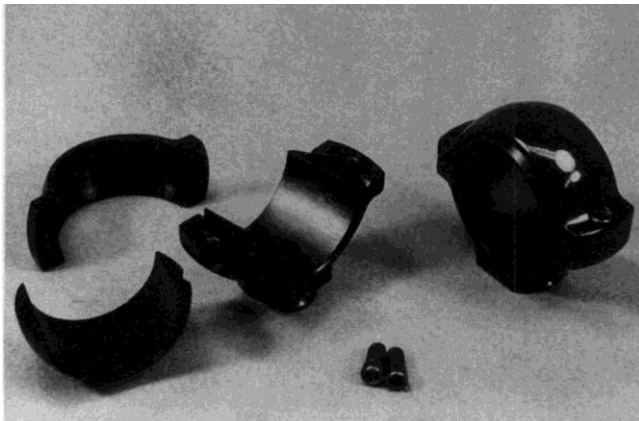
Once the front ring is centered install the rear ring. The Leupold mount uses a rear ring just like the front one. Turn the ring until it looks centered, then remove the upper half of both rings. Place the scope into the rings. If the front and rear are aligned the scope will move smoothly into place, and rotate without binding. If the scope will not slide right in, adjust the rear ring with the rod or bar.

The Burris and Redfield mounts use a pair of cross screws that both clamp and adjust the rear ring. Place the rear ring on the base and screw the cross screws partway in. Place the scope on the rings and centered on your collimator grid. Tighten the cross screws with your fingers, keeping the crosshairs centered.

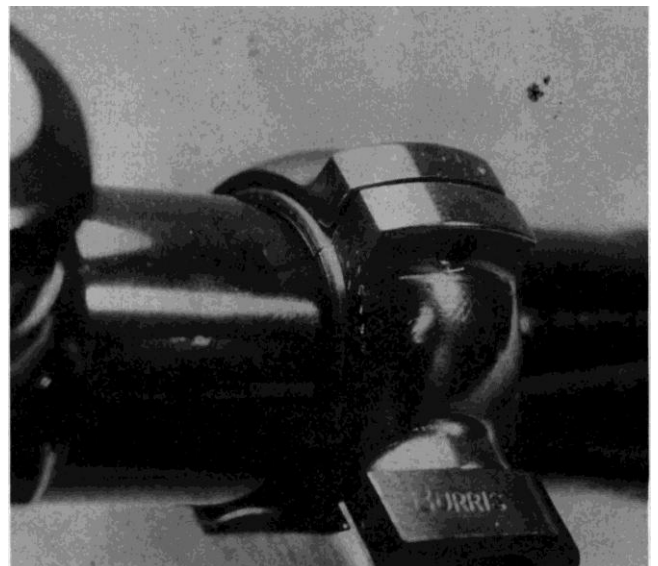
For all these mounts, if you do not have a bore collimator use a distant object. Without the collimator or distant object, get the rings straight to the bore by eye. Make sure the scope does not bind in the rings, and sight in at the range.

With the front and rear lower rings lined up, place the scope in them and tighten the upper halves. Once the ring screws are tight on the Redfield rings, tighten the rear cross screws on the base.

As much as you have tried to keep the crosshairs vertical, when you pull the mounted scope out of the vise the crosshairs will not be straight. Loosen the ring screws just enough to rotate the scope. Hold the revolver in your shooting grip and adjust the crosshairs until they are vertical. Tighten the ring screws.



The Burris Pos-Align rings use plastic bushings to grip and align the scope without harming it.



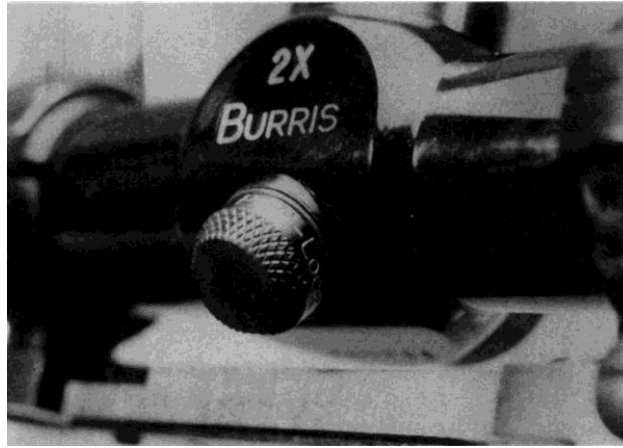
The Burris Pos-align rings compress their plastic bushings to clamp the scope and hold it in place.

Scopes for hunting

The common use of the hunting handgun is big game at close to medium ranges. You need low power, large crosshairs, and a bright, durable scope. How low the power depends on the game. For example, when deer hunting in Michigan the longest likely shot is under 100 yards, and the average shot is less than 50. The deer hunter will be well served with a scope of 2X or 3X. A hunter who is after wild boar in Tennessee will be engaging his future ham sandwiches from 20 yards to 20 inches. The boar hunter will probably want to go with a 1X (no magnification) or 1.5X scope.

With the poor light of dusk and dawn, a background of trees and bushes as well as the general litter of the forest floor, fine crosshairs are a handicap. To get the job done, you need bold crosshairs. Leupold scopes offer even more, with their German designed “3-post” reticule. It is a set of three posts, one vertical from the bottom of the scope, and a horizontal one from each side. The vertical post comes to a point. In fast shooting such as wild boar hunting, if the three posts are on the boar’s shoulder you have an acceptable sight picture. For finer shooting on a deer at 100 yards, the point allows finer adjustments.

The scope you use for hunting must be tough. The travel through the woods to a hunting blind is not always easy and even the best hunter will stumble and fall once. Should you be the only hunter who has never tripped and dropped his weapon, the recoil of a .44 Magnum is just as tough on scopes. Because I have never had a Burris or Leupold scope fail me I favor them on handguns.



For heavy-recoiling calibers, the Burris scopes have a Posi-lock that tightens the settings and keeps them from working loose.

Chapter 21 - The Thompson/Center Contender

The T/C Contender is a specialized handgun that fills its niche so well it has never had a serious competitor in its entire existence. This single-shot handgun opens by pulling the trigger guard back and up. A quick positive pull is preferred to a steady squeeze. The muzzle pivots down. The rear of the barrel hinges up, exposing the chamber. With the barrel open, you can load or unload the handgun.

The Contender is available in a dizzying range of calibers. Over the years what the factory offers has varied with shifting customer tastes. These days you can get barrels in .22 rim-fire up to .30-30 Winchester. Almost any caliber you can name has been offered at some point in the past. Once a caliber gets dropped from the lineup, though, the collectors move in. You may have to search diligently to find a barrel in .38 Super or .218 Bee, and snatch it up before a collector does.

The Contender has two safeties. Turning the hammer safety lever allows you to select the pin for rim-firing or the pin for center-firing. With the lever nose to the left (the 10 o'clock position) you have selected rim-fire. With the selector nose to the right (two o'clock) you have selected center fire. With the nose in the middle (noon) you are on safe. You should leave the selector on safe until you are ready to fire, and turn it as you cock the hammer.

The second safety is an internal hammer block that slides between the hammer and the firing pin each time you open the action. The internal hammer block disengages when you cock the hammer. If, after cocking the hammer you decide you do not want to fire, you must follow this procedure exactly: Set the hammer selector/safety in the center position. Place your thumb on the hammer, and pull the trigger. With your thumb, ease the hammer down. Pull the trigger guard back and up to open the action. Close the action. You have now re-engaged the internal hammer block.

If you simply lower the hammer, the internal hammer block will not prevent forward movement of the hammer. As with the older designs of the single-action revolver, a sharp blow to the hammer may fire the chambered round. You must move the selector to safe and re-engage the internal hammer block.

There is an added reason to open the action: If you don't, you can't cock the handgun again! Opening the action resets the trigger and sear, which in turn allows you to cock the handgun. Until you reset the mechanism you can draw the hammer back all you want, but you can't keep it cocked.

The design of the trigger and sear engagement allows dry firing and testing of the trigger pull without cocking the hammer. If you first open and close the action, you can then dry fire. You can do this all day to your heart's content. The trigger pull will be exactly the same as if you had cocked the hammer. You'll get the benefits of dry-firing without putting wear and tear on the hammer and firing pin.

Uses of the Contender

The Contender is used for hunting and competition. Along with .44 Magnum revolvers, the Contender established handgun hunting as a sport. With a Contender in a serious hunting caliber, a handgun hunter does not have to feel apologetic about the tools of his sport. Deer hunting with a .38 Special handgun can only be viewed as a stunt, and a painful hoax on the deer. A handgun in .30-30 Winchester, .35 Remington or .45/70, however, is a formidable tool for hunting. After all, millions of hunters go into the hunting fields each year with rifles in these calibers.

If power is good, then more power is better. Or so the thinking goes in some quarters. If you do not feel that you can get enough power for hunting right from Thompson/Center, there is an outfit for you called SSK Industries. Run by J. D. Jones, SSK can make a new barrel for your T/C Contender in just about any caliber you can imagine. J. D. 's forte is calibers that are so stout you must have a muzzle brake on your barrel. So stout, in fact, that if you were to chamber a rifle for them you would want the rifle to have a recoil pad on it. Not surprisingly, he calls some of them Hand Cannons.

In target competition the Contender does not need nearly this much power. A factory-issue model in the appropriate caliber will do.

At the International Handgun Metallic Silhouette Competition shooters must knock over steel plates cut out in the shape of game animals. The largest and farthest of these is a ram, at 200 meters. As you can imagine, a ram made of steel thick and hard enough to withstand the bullet's impact is heavy. It takes quite a bit of power to knock the ram down. Handguns and rifles must have at least as much power as the .44 Magnum. Since the competition involves at least 40, and even as many as 80 shots, a caliber that has too much recoil will fatigue even the hardest of competitors. Target shooters need the perfect combination of high power and low recoil.

The Masters handgun match, held each year outside of Quincy, Il. also has a long-range handgun match. With circular steel plates from 50 to 200 meters, the competitors need a flat-shooting handgun with enough power to knock down the steel.

In cases like these the Contender gets the nod.

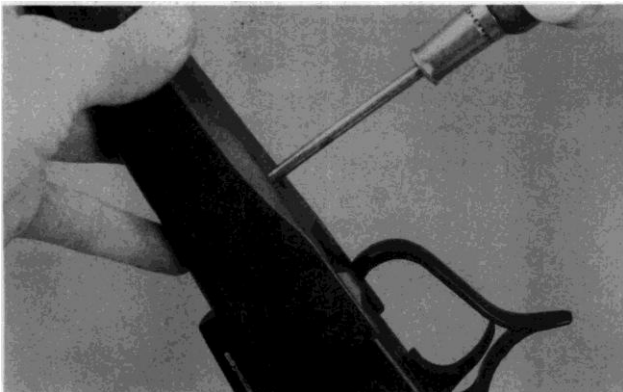
Changing barrels

The greatest advantage of the Contender is its interchangeable barrels. You can change from one caliber to another for the cost of a barrel. For cheap practice, use a .22 rim-fire barrel. For hunting or competition, take a few minutes and change the barrel.

Make sure the handgun is unloaded. Remove the screw that holds the fore-end to the frame. Open the action. Press the hinge pin out of the frame from either direction. Place the new barrel into the frame and press the hinge pin through the barrel's lug. Swing the barrel closed, and screw the fore-end back on.



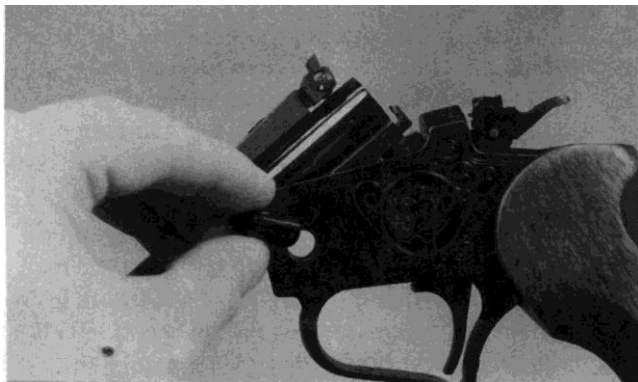
You can have two, three, 10 calibers just by switching barrels.



(1) To switch barrels on the T/C, remove the fore-end.



(2) Open the action.



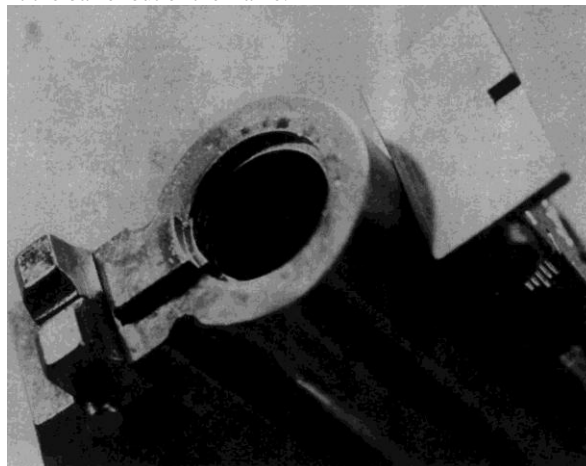
(3) Press the hinge pin out of the frame.



(4) Lift the barrel out of the frame.



(5) Here the shorter barrel has been installed.



The locking block is the wider one under the extractor.

Fitting a new barrel

A Contender barrel has locking bolts that stick out under the chamber. Dykem the locking bolts of your new barrel. Install the barrel in the frame and close the action. Open the barrel and look at the locking bolts. You should see the Dykem rubbed from the locking lugs across at least half their length. If it is, your barrel fitting is done. If it is not, tool marks are preventing the locking lugs from fully engaging. With an extra-fine stone carefully stone the top of the locking lugs. You want to polish down the tool marks, not lower the lugs or change their angle.

After two passes of the stone, re-apply Dykem and check the fit. This much stoning is usually all it takes. If the barrel doesn't even come close to the halfway mark and it is a T/C barrel, send it back with a detailed explanation. If it is a barrel from a manufacturer other than T/C, send it back to that maker.

Headspace and the Contender

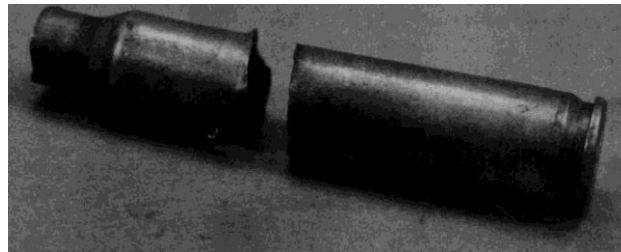
The Contender action is very strong, but there are mechanical limits it cannot avoid. The action flexes microscopically, especially when high-pressure cartridges are used. The flexing does not alter the strength or usefulness of the pistol, but does allow the cases to stretch. When you use a barrel chambered for a handgun or a low-pressure straight-walled rifle cartridge, case stretching is only a minor problem. Keep your brass sorted into batches. After you fire each batch of brass, measure the length of a random selection. When those measured get to the maximum allowed length, trim all of the batch.

The problem gets worse with bottle-necked cases, especially high-pressure ones. You must full-length resize each case after each firing, and measure its length to see if it needs trimming. When the case stretches, the shoulder moves farther from the rim. When you resize the cases, you must push the shoulder back to its previous location, or the action will be hard to close.

Keep your Contender handy when setting up your sizing die. Use a new, unfired case as a comparison. Close the action with the new case in place and get a feel for how much force it takes. Try to close your Contender with a fired, un-sized case in it. You probably can't. Adjust your sizing die to size the case, and after wiping off the sizing lubricant try closing the action again. Keep adjusting the sizing die down until you can close the action as easily as you can with the new case.

Do not adjust the sizing die any more. If you do, you will be pushing the shoulder back farther than its starting point. Sizing this far back will cause early case failure. Under the pressure of firing, the shoulder or neck of the case will crack. You may also experience a case separation.

With proper sizing die adjustment you will get many loadings out of your cases before you finally have to retire them. Brass does not last forever. While stretching increases its length, it shortens its life. When you see a bright ring half an inch above the rim your brass is ready to quit. Retire the whole batch.



Overworking your brass in the T/C will lead to case separations. Full-length resize, but do not set the shoulder back too far.

Trigger adjustment

Unlike other handguns the trigger mechanism of the Contender is intended to be adjustable. Adjustments are made first with the engagement screw and then the overtravel screw.

The engagement screw is located in the top of the trigger, in front of and above your trigger finger. Turning the adjustment screw clockwise will decrease the engagement and shorten the let-off travel. A counterclockwise turn will increase engagement and let-off travel. The trigger is adjusted at the factory for an optimum safe let-off travel.

If you feel the trigger pull is too heavy, here's how to adjust and check. Make sure the handgun is unloaded, and dry fire it. With an alien wrench give the engagement screw a quarter-turn clockwise. Open and close the action and try the trigger pull. If you like it, then test sear engagement to see if the hammer will stay cocked. Open the action and cock the hammer. Close the action briskly. Do this several times. If the hammer falls, you have gone too far. You must turn the engagement screw counterclockwise to increase let-off travel until the hammer stays cocked during this test.



The engagement adjustment screw is on the front of the trigger.



The over travel screw is on the back of the trigger guard.

Even if the factory trigger setting is too heavy, it doesn't take very much adjustment to make the trigger feel lighter.

The trigger stop screw is in the trigger guard directly behind the trigger. The screw controls the amount of overtravel of the trigger. Again, test with an unloaded handgun. With your engagement and let-off adjustments done, turn the stop screw clockwise until the sear will not release when you pull the trigger. Turn it counterclockwise until the sear will release when you pull the trigger. Give the screw an additional quarter-turn counterclockwise as an assurance that the trigger will release the sear every time.

If you are going to be using calibers with more power than the .44 Magnum, put a dab of paint or nail polish on these screws. This will prevent the vibrations of shooting from moving the screws and changing your settings.

As long as your trigger adjustments are done only with these two screws, the Contender remains under warranty. If anything goes wrong you can always send it back for the factory technicians to puzzle over.

If you get in there and do any polishing, grinding or spring replacements, you void the warranty.

If you need a better trigger pull than the adjustment screws can give you (a rare situation, indeed) then you must use a stoning fixture such as the Powers fixture.

Scope mounting

Unlike other handguns, I use Loctite to secure the bases to Contenders on any caliber larger than .44 Magnum. The vibration and recoil from a 7-30 Waters or .30-30 Winchester is enough to undo even your best efforts at tightening screws. Burris Pos-Align rings are particularly useful on the Contender. The Pos-align bushings fit between the rings and the scope. Made of a special plastic, they do two things. One, they spread the clamping force of the rings over the full surface area between the rings and scope. This lets you clamp the scope harder than standard rings without marring or kinking the scope. Two, the larger effective surface area prevents sliding under recoil. As with many other scope mount manufacturers, Burris now ships their bases and rings with Torx® screws.

To apply Loctite you end up installing the scope twice. Use a mild grade of Loctite. Remove the plug screws from the barrel and bolt the scope base down. If you are using a Burris, Redfield or Leupold mount, adjust the rings until the scope is zeroed. With the Burris Pos-Align, place the bushings in the lower rings when you check adjustments with the scope. Clamp the scope in the rings and check the clearance of the hammer. Can you get your thumb in there and move the selector? Can you cock the hammer? If not, move the scope until you can.

Once the scope is positioned, remove the scope from the rings, and the base from the barrel. Degrease the barrel, base and base rings. Apply Loctite and tighten the screws. De-grease the rings and the ring screws. Many scope rings come with friction paper. Use it, placing it on the rings. Replace the scope in the rings exactly as it was when you took it out. Apply Loctite to the ring screws and tighten the upper halves of the rings in place. Make sure the scope reticule is vertical as you tighten the rings in place.

With the mount secured this way, you will have to go to extra effort to change scopes or mounts. More muscle should remove the ring screws if you decide to change scopes or mounts. If you used a too-strong grade of Loctite, muscle won't work. You will have to use your drill press to drill the heads off the ring screws. If you are also removing the base, then a propane torch will break down the Loctite at 400 degrees Fahrenheit. Don't use the torch on the ring screws; it will damage the scope.

Chapter 22 - Learning More About Pistolsmithing



If you are thinking of getting a handgun refinished, get catalogs. If you buy anything from Brownells you will get their brochure "Benchtalk," relating to things gunsmithing in general.

There are many sources for learning more about pistolsmithing.

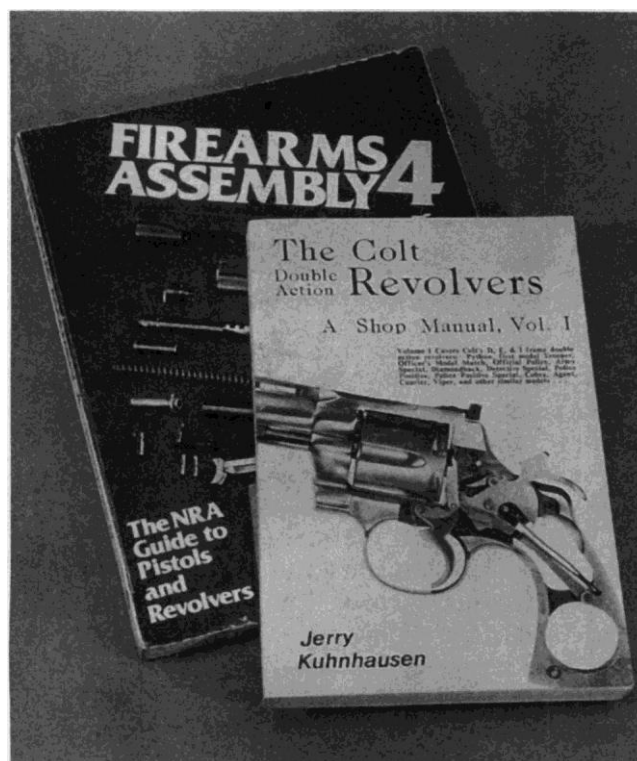
If you buy a tool that will aid your pistolsmithing efforts, and it is more complicated than a file or a hammer, it will come with instructions. If you bought the tool from Brownells their staff of able and experienced gunsmiths will be able to help you if some part of the instructions isn't clear.

You can buy introductory, intermediate and advanced books on pistolsmithing. You can cast a wide net and read on all kinds of handguns, or you can be selective and specialize in only one. A good start for the generalist is The Gun Digest Book of Exploded Handgun Drawings, which shows all the parts of 488 handguns in their correct positions. J. B. Wood also offers a series of books on takedown and reassembly, with a volume each for revolvers and auto pistols. If you run into a handgun you haven't seen before, you can look it up and find out how to take it apart. For more explanations on disassembly and reassembly, the NRA publishes a volume on handguns. You don't need all of these, just the one (or two) that cover the handguns you own. The professional pistolsmith owns all of them and more. Of course, if you buy a new handgun, you may have to add a book or two.

Books on pistolsmithing specific handguns are not hard to find. Ed Brown, Bill Wilson and Layne Simpson all have books devoted to the 1911. One series of books on pistolsmithing that is very useful come from Jerry Kuhnhausen. Jerry spent decades as a professional gunsmith on the West Coast, and his books are the distillation of the working notebooks he used. Don't expect to sit in a comfy chair and read for an evening. Instead, use Jerry's books to zero in on a specific dimension of a specific handgun. From there, you can add to your library with books on pistolsmithing tricks and techniques, or on tools and their uses.



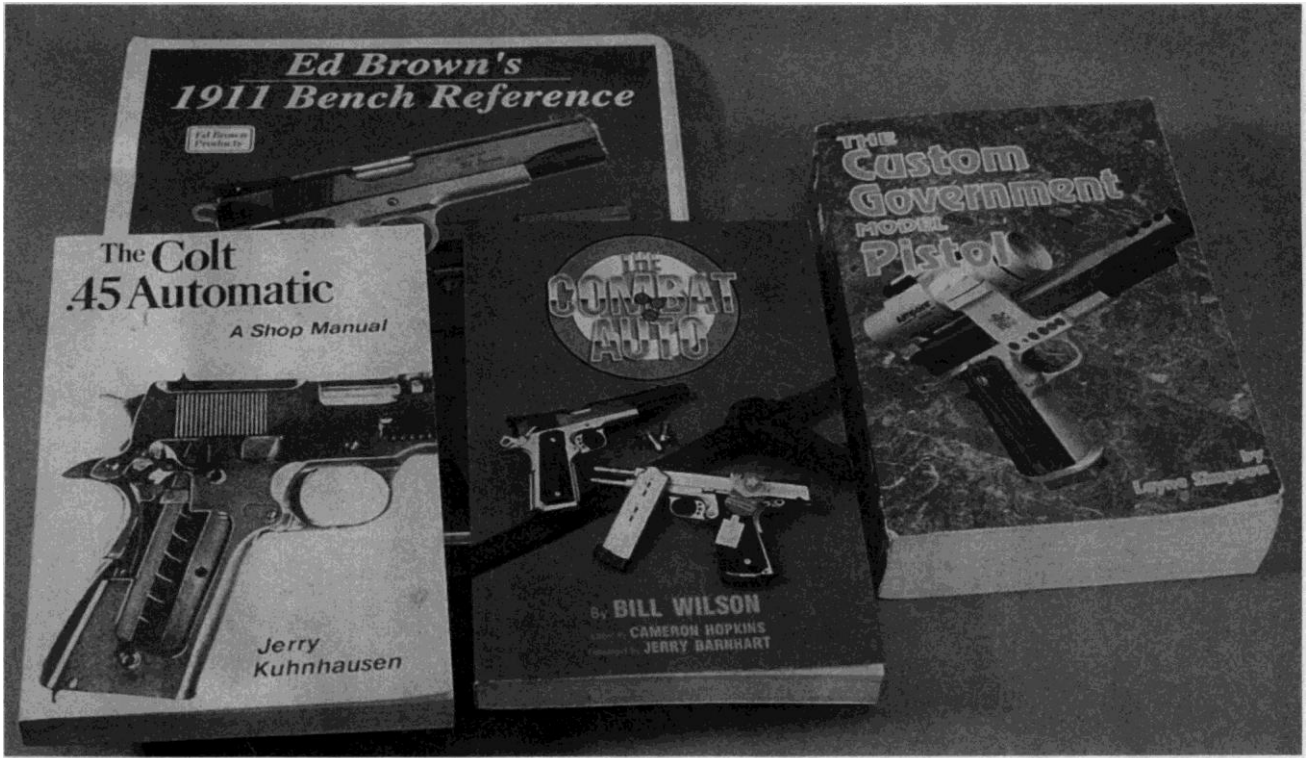
The owners manual, NRA publications and manufacturers catalogs all contain a wealth of information.



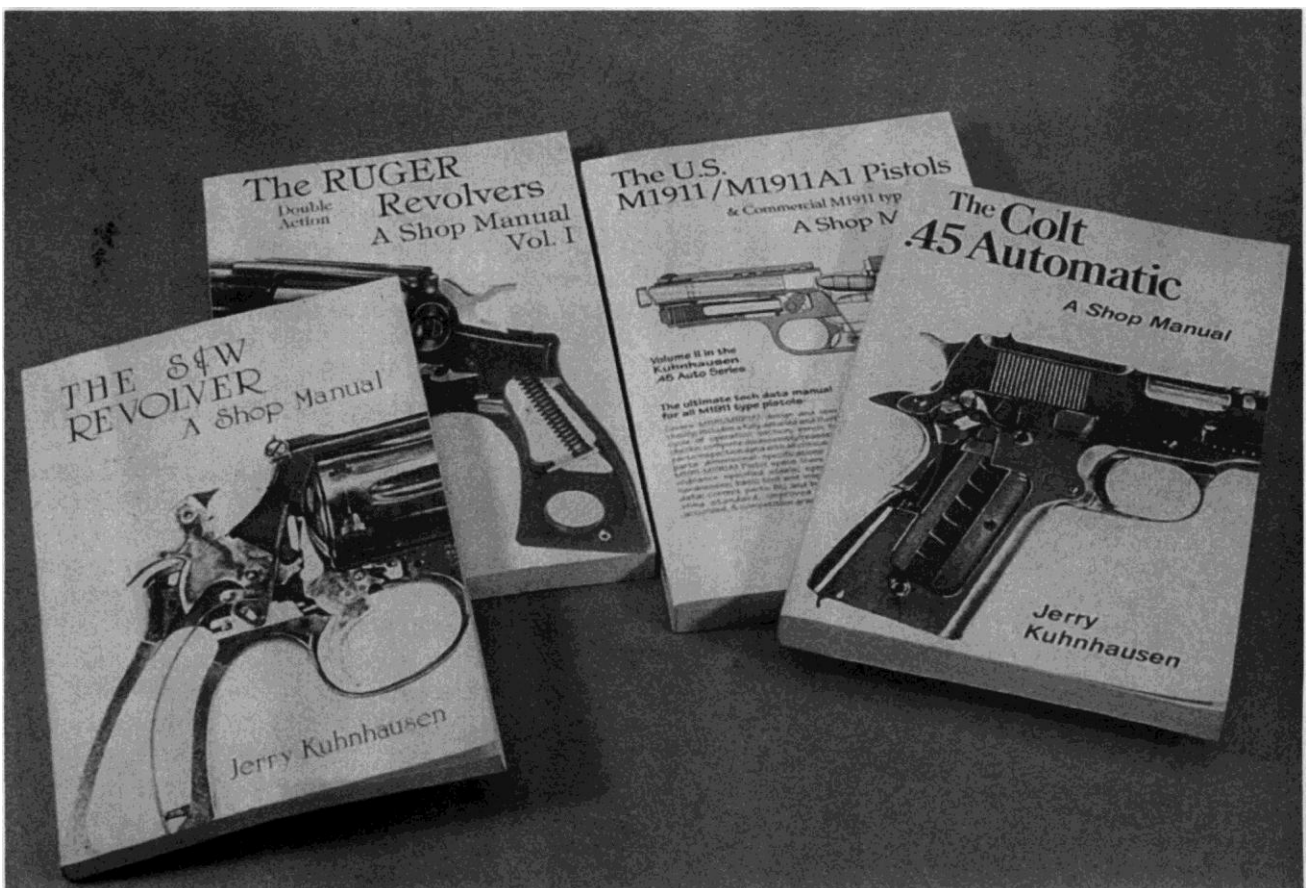
The simplest library would be the NRA disassembly manual, and a Kuhnhausen book on your particular firearm.

The magazine stands are full of monthlies on the subject of firearms. By scanning the title pages, you can find the issues that have pistolsmithing projects of interest. If you try to subscribe to them all you will be buried by the monthly tidal wave of mail.

Those young enough to be immersed in the TV era may feel that video tapes are all you need. Not true. Video tapes act as a perfect complement to books. One of the very useful aspects of videotape is seeing the procedure as it happens. You can observe the path of a file as the pistolsmith follows a curve. Or you can watch him using a hammer and get a better impression of how hard to strike than you could from reading pages of description. Remember, though, that videotapes are an expensive way to learn. Four hours of videotape cost much more than a book, and do not have as much information.



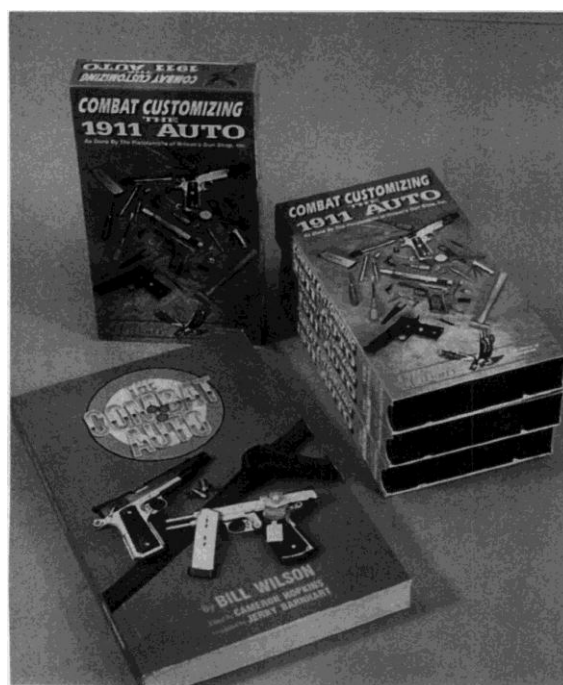
You can build your library around a single firearm, like the 1911.



The Kuhnhausen series of books are very detailed, and firearm specific.



Scan the magazines for articles on pistolsmithing. If you subscribe to them all, you will be buried under a tidal wave of coated paper.

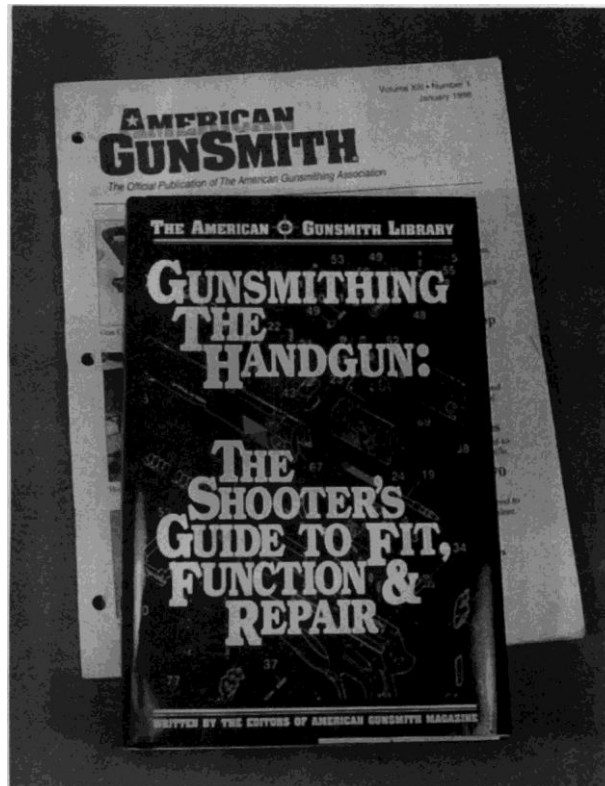


Video tapes are a good way to add to your knowledge of a particular firearm or tasks performed on it.

Bill Wilson offers a four-tape series on the 1911. He also offers tapes on cleaning six other handguns. Clark Custom offers tapes on disassembling, reassembling and customizing the 1911 and the Ruger Mk II .22, with others on the way. The American Gunsmithing Institute offers 56 tapes that total 103 hours! For the largest cross-section of titles on cleaning, customizing and use, get a catalog from Gun Video. Lenny Magill has been making videos for many years, and has more available than you probably have time to watch.

If you want more than books and videos offer, consider mail-order instruction. You can learn to do all the tasks of pistolsmithing, with step-by-step instructions showing up once a week or once a month.

The big plunge is going to school. There are colleges that offer a degree in gunsmithing. If you are definitely going to go into pistolsmithing for a living, then this makes sense. The Colorado School of Trades, Lassen Community College and Yavapai College can give you a two-year grounding on being a gunsmith. While most of the colleges that teach gunsmithing are west of the Mississippi, for those on the East Coast, Montgomery Community College offers a gunsmithing curriculum. In addition to teaching you pistolsmithing techniques, these schools will also teach you how to run a business. If you are going to go pro, you have to know more than just the stock numbers for common parts. You also have to keep track of things like taxes; bookkeeping requirements to satisfy the Bureau of Alcohol, Tobacco and Firearms; your presentation to customers; and the proper bearing at the counter.



The American Gunsmithing Association does not require you to be a professional gunsmith to join. You can learn many useful things.

If spending two years at college is more than you wanted to know about pistolsmithing, but you still want to learn something, then a short vacation may suffice. A number of the name gunsmiths in the country offer weekend classes on specific handguns. These are usually held just before a competition. You show up a couple of days early and spend the time learning how to assemble or customize the handgun selected. If your efforts are up to the challenge, you may even use what you learned in the match that follows.

Cylinder & Slide offers a class of this kind each year, as does Nowlin. If you're willing to spend part of your vacation travelling and then working, you could come back with a custom 1911 built with your own hands. The classes offered by professional gunsmiths are focused on the handguns they specialize in, or make accessories for. The NRA offers short-term classes on a wider range of handguns. These are offered in conjunction with the colleges that offer gunsmithing courses. A long weekend, or a week spent at one of these classes will teach you everything you need to know about a particular handgun, or some aspect of pistolsmithing.

Most of the professional organizations require you be a full-time pistolsmith to join. One that does not, and provides a monthly magazine that is full of information, is the American Gunsmithing Association. While they also cover rifles and shotguns, there seems to be something about handguns in every issue.

Once you get started on the path, there is no end to it.

A Quick Troubleshooting Guide

Pistols

Failure to feed

Check the following:	• Dirty pistol? Clean.
• Wrong magazine? Replace.	• Rough breech face? Stone breech face.
• Bad magazine? Replace.	• Rough or sharp chamber mouth? Stone tip-over line.
• Poor-quality reloaded ammunition? Buy factory ammo.	
• Weak recoil spring? Replace	• Shooter limp-wristing? Firmer grip.

Failure to chamber

Check the following:	• Dirty chamber? Clean.
• Poor-quality reloaded ammunition? Buy factory ammo.	• Insufficient headspace? Ream chamber.
	• Rough chamber? Ream & polish.
• Dirty pistol? Clean.	• Weak recoil spring? Replace.

Failure to fire

Check the following:	
• Pistol loaded? Load.	• Bent, jammed or broken firing pin? Replace.
• Magazine fully inserted? Press into place.	• Series 80 firing pin safety? Correctly assemble.
• Poor-quality reloads? Buy factory ammo.	• Weakened or shortened mainspring? Replace.

Failure to extract

Check the following:	• Dirty pistol? Clean.
	• Weak ammunition? Buy factory ammo.
• Rough chamber? Ream & polish.	• Heavy recoil spring? Replace.
• Pitted chamber? Replace barrel.	• Insufficient extractor tension? Adjust tension.
• Dirty chamber? Clean.	• Extractor chipped or broken? Replace.

Failure to eject

Check the following:	• Ejector loose or altered? Tighten or replace.
	• Slide sidewall too high? Lower sidewall.
• Extractor tension? Adjust tension.	• Recoil spring too heavy? Use lighter spring.
• Ejector present? Replace ejector.	• Shooter limp-wristing? Tighter grip.

Failure to cock

Check the following:	• Broken/alterd sear? Replace sear.
• Correctly assembled? Reassemble.	• Hammer hitting grip safety? Replace hammer/safety.
• Broken/alterd hammer? Replace hammer.	• Sear spring tension? Increase tension.

Sudden or gradual loss of accuracy

Check the following:	
• Leaded bore? Clean bore.	• Bulged barrel? Replace barrel.
• Dirty pistol? Clean pistol.	• Wrong bushing in 1911? Replace or refit.
• Wrong ammunition? Change ammo.	• Broken link? Replace link.

Revolvers

Failure to chamber

Check the following:	• Wrong ammunition? Use correct ammo.
• Poor-quality reloads? Use factory ammo.	• Nicked chamber mouth? Stone nick.

Failure to close

Check the following:	
• Unburned powder under extractor star? Clean under extractor.	• Bent crane? Align crane.
	• Ejector rod bent? Straighten.
• Ejector rod unscrewed? Tighten rod.	• Wrong sideplate screw? Change front screw.
• High primer? Inspect ammo.	• Burred firing pin hole? Stone flush.
• Wrong ammunition? Use correct ammo.	

Failure to rotate

Check the following:	• Cylinder binding on barrel? Check cylinder gap, remove endshake.
• Hand loose? Tighten.	• High primer? Inspect ammo.
• Hand missing? Replace.	• Bullet stuck in cylinder gap? Remove bullet, ammo.
• Hand incorrectly assembled? Reassemble.	
• Cylinder bolt not unlocking? Check timing.	• Bent crane? Align crane.

Failure to cock

Check the following:	• Mainspring knuckling? Tighten screw.
• Grips interfering with hammer? Alter grips.	• Cylinder binding on barrel? Check cylinder gap, remove endshake.
• Single-action notch worn or altered? Replace hammer.	• High primer? Replace ammo.

Failure to fire

Check the following:	• Excessive endshake? Remove endshake.
• Revolver loaded? Load.	• Weakened mainspring? Replace.
• Poor-quality reloads? Use factory ammo.	• Loosened strain screw? Tighten.
• Firing pin bent, broken or missing? Replace.	• Cylinder skipping? Adjust timing.

Failure to return the trigger

Check the following:	• Dirty revolver? Clean.
• Weakened rebound spring? Replace.	• Short-stroking trigger? Heavier rebound spring.

Failure to open

Check the following:	
• Ejector rod unscrewed? Tighten.	• Bullet across cylinder gap? Remove bullet.
• Poor-quality reloads? Use factory ammo.	

Failure to eject

Check the following:	• Dirty chambers? Clean.
	• Use of short brass? Ream leaded chamber.
• Poor-quality reloads, high pressure? Use factory ammo.	• Pitted chambers? Replace cylinder.
	• Bulged chamber? Replace cylinder & ammo.

Sudden or gradual loss of accuracy

Check the following:	
• Leaded bore? Clean bore.	• Bulged barrel? Replace barrel.
• Poor-quality ammunition? Use factory ammo.	• Skipping cylinder? Adjust timing.
	• Eroded forcing cone? Setback & re-cut.
• Dirty? Clean.	• Excessive cylinder gap? Setback & re-cut.

Glossary

- Accurize** —To improve the accuracy or performance of a handgun by either tightening the fit and smoothing the action, or replacing working parts with parts of higher quality.
- Backstrap** —The rear of the grip frame that rests against the palm of the shooting hand.
- Bianchi Cup** —The trophy awarded at the NRA Action Pistol Championships, and the original name of the match.
- Bowling pins**—A variant of practical shooting that uses actual bowling pins as targets. The object of a bowling pin shoot is to knock a certain number of bowling pins off of a table. The fastest time wins.
- Brass** —A single, empty cartridge case, or several of these cases.
- Breech face** —The part of the slide in a self-loader, or the frame on a revolver, where the firing pin protrudes, to ignite the primer.
- Bushing** —Any sleeve that holds another part.
- Bushing, barrel** —A sleeve on the front of a slide that contains the barrel, and fills the gap between the barrel and slide.
- Bushing, grip** —A small cylinder that is screwed into the frame, that contains the threads to hold the grip screws.
- Caliber** —A numerical term describing a particular cartridge size and operating pressure. A caliber may have different designations, i.e., 9mm Parabellum, 9mm Luger.
- Cartridge** —A single, loaded round of ammunition.
- Chamber** —The recess in the rear of a barrel (pistol) or the cylinder (revolver) where the cartridge rests during firing.
- Chamfer** —Breaking or rounding the edge. Frames, slides, cylinder and sights are chamfered. The muzzle of a barrel is crowned.
- Compensator** —A device that re-directs the gasses of combustion, to reduce felt recoil or muzzle rise.
- Crane** —A large bird, beautiful in flight, that is amazingly clumsy in landings. Also the pivot arm of a swing-open cylinder of a double-action revolver. Also known as a yoke.
- Cylinder** —The cylindrical part of a revolver, that rotates to bring each chamber in line with the barrel.
- Cylinder gap** —The gap between the front of the cylinder and the rear of the barrel.
- Cylinder Stop** —The locking bolt that secures each chamber of the cylinder in line with the barrel during firing.
- Dehorn** —To remove sharp edges from a handgun, or parts of a handgun.
- Disconnecter** —A part that removes the trigger from the firing linkage as the mechanism cycles. Prevents fully-auto-matic fire.
- Double-action** —A revolver or pistol that can be fired by simply pulling the trigger without first manually cocking the hammer. Or the act of firing a revolver or pistol, by pressing the trigger to both cock and then fire the handgun.
- Elevation** —Correction of bullet impact or sights in a vertical direction.
- Ejector** —On pistols, a fixed post or spring-loaded plunger that tosses the empty brass out at the end of the firing cycle.
- Ejector rod** —On revolvers, used to eject the cartridges, loaded or fired.
- End play** —Movement of the cylinder forward and back on its crane. A small amount is needed for free rotation. Too much harms accuracy, lowers velocity, and causes spitting.
- Erosion** —Wear in the forcing cone of a revolver barrel, due to the hot gases of combustion. On the pistol, erosion wears away the beginning of the rifling, just ahead of the chamber.
- Extractor** —A hook or shelf that pulls cartridges out of the chamber.
- Feed lips** —The top of a magazine, the parts that guide the top cartridge forward and upward, towards the chamber.
- Feed ramp** —The portion of frame or barrel between the magazine and the chamber.
- Firing pin** —The connection in the firing linkage between the hammer and the primer of the cartridge. On some revolvers, the firing pin is fixed to the hammer.
- Forcing cone** —A flaring of the rear of the revolver barrel, to guide the bullet from the cylinder into the rifling of the barrel.
- Fore-end** —A wood, metal or plastic handle forward of the trigger. On a T/C Contender, it also holds the barrel on. A fore-end on pistols may not, under federal law, be vertical.
- Grip safety** —A lever in the backstrap of a pistol that interrupts the firing linkage unless held down in the firing grip.
- Hammer** —A pivoting part of the firing linkage that delivers the power of the mainspring to the firing pin, or primer.

Hand —The hand rotates the cylinder in a revolver.

Headspace —The size of the chamber, plus and minus the allowable tolerances. Insufficient headspace leads to malfunctions. Excessive headspace is hazardous.

ICORE —The International Confederation of Revolver Enthusiasts, the organizing body of the International Revolver Championships. This is practical shooting with revolvers, high speed shooting and running, unlike the static matches of PPC.

IPSC —The International Practical Shooting Confederation, the world organizing body for practical shooting and competition.

IRC —The International Revolver Championships, held annually by ICORE. It is an organization and match devoted to the use of revolvers in practical competition.

Limp-wristing —Causing a malfunction in the cycle of a pistol by holding it too loosely. The force of the recoil is absorbed by the shooters limp hand-wrist-arm, and not enough is left to work the action.

Link —Some pistols require a link to pivot the rear of the barrel up for locking and down for unlocking. Found on the Colt 1911.

Loading gate —On single-action revolvers. The cylinder does not swing out, so the loading gate is used to load and unload the cylinder.

Lug —Commonly a locking lug. On the 1911 barrel, there are multiple upper lugs and a lower, cam lug. On newer designs, the chamber locks into the ejection port. The lower, cam lug is an angled shoulder.

Magazine —Contains the cartridges in a pistol. Commonly, and mistakenly referred to as a “clip.” A magazine contains a spring for feeding, a clip does not.

Magazine catch —The catch that holds the magazine in the frame of a pistol.

Magazine safety —A part of the firing linkage. If a pistol contains a magazine safety, and the magazine is not inserted into the pistol, the pistol will not fire. Not all pistols have magazine safeties. On those that do, it can be removed. When removed, the pistol will fire without a magazine in the frame. People have died as a result of accidents where they thought a magazine safety would prevent their being shot, where the magazine safety had been removed.

Mainspring —The spring that powers the hammer in firing. The compressed force of the mainspring is directed through the hammer to the primer.

Muzzle —The bullet’s exit point in the end of the barrel.

Night Sight —Sights that glow in the dark. Commonly they contain small vials of Tritium, with a useful life of five to 10 years.

NRA —National Rifle Association. An association of the firearms owners of the US, that organizes competition, training, and political representation.

Patridge sight —A sight with rectangular sight and notch, the most common design now made. In earlier decades, front sights were often rounded, sitting in “U” shaped rear notches.

Peen —To move metal by striking it with a hammer. Peened parts are slightly distorted by the impact, and often have to be filed, stoned or lapped to fit properly. Used to fill small gaps between parts without welding or silver-soldering.

Pilot —A guide rod, used to keep a barrel in line with a cutting tool, or a cutting tool in line with the hole it will be reaming or chamfering.

Pistol —A self-loading handgun that feeds from a magazine. Or a single-shot handgun.

PPC —Police Pistol Competition. Started as a course of fire for FBI agents in the 1930’s, PPC was devoted to revolver competition until the 1990’s. The transition to pistols by many police departments brought large numbers of pistols to PPC shooting. Organized and run under the auspices of the NRA.

Ratchet —A notched ring on the rear of a revolver cylinder that the hand uses to rotate the cylinder.

Rebound block —A rectangular part of the revolver mechanism used to push the trigger back to its resting place, and to cam the hammer away from the primer.

Recoil —The reactive force of firing a handgun. The energy for propelling a bullets generates an equal and opposite force. This recoil must be accepted or re-directed by the shooter.

Recoil spring —The spring under or around the barrel of a pistol that stores energy from the recoil, and uses it to feed the next cartridge into the chamber.

Reticule —The aiming marks on a scope.

Rifling —Spiral grooves cut or swaged into the bore of a barrel. The bullet passing down the barrel is rotated by the rifling, stabilizing the bullet for its trip to the target.

Short-stroking —In double-action revolver shooting, failure to allow the trigger to re-set will jam the mechanism. The rebound spring is usually too light and must be replaced.

Sideplate — The access hatch to a revolver mechanism. Not all revolvers have a sideplate.

- Single-action** — The action of firing a revolver by first cocking the hammer, and then pressing the trigger. Also, a revolver that may only be fired this way.
- Skipping** — Failure of the revolver cylinder to lock in place when rotated into line. If the cylinder is sufficiently out of alignment with the barrel, but still fires, damage to the revolver and injury to the shooter may result.
- Slide Stop** — A lever on the side of a pistol frame, that locks the slide back when the ammunition in a magazine has been exhausted.
- Soldering** — Joining two pieces of metal by heating them and introducing a different metal into their gap.
- Spitting** — The spray of gasses and bullet particles that are projected sideways from a revolver when the cylinder gap is too large. To correct, the barrel must be set back, and the gap correctly cut.
- Steel Challenge** — A match devoted to the speedy use of handguns on steel plates. The plates do not have to fall down, and the fastest times win.
- Strain screw** — The screw that tensions the mainspring on a revolver.
- Swage** — To move metal by cold-forming it, or pressing with a large and heavy bar shaped for the purpose.
- Thumb safety** — A safety, usually operated by the thumb, on the slide or frame of a pistol that must be pressed to ready the pistol for firing.
- Top Strap** — The upper part of a revolver frame. Commonly this is where the sights or scope mount is attached.
- Underlug** — The lower part of a barrel. The underlug can either contain extra locking parts, as on the Smith & Wesson, or simply provide protection to the ejector rod, as on Colt and Ruger revolvers.
- USPSA** — The United States Practical Shooting Association, the organizing body for practical shooting and competition in the US.
- Welding** — Joining two parts by heating their edges until the metal melts, and adding a filler to the joint.
- Windage** — Movement of the bullet or sights from side to side. Also the correction of sights side to side.

Sources

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 Ahrends Custom Firearms Box 503 Clarion, IA. 50525 515-532-3449 FAX: 515-532-3926
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 Aristocrat Products P. O. Box 523 San Gabriel CA. 91778 626-287-4110 FAX: 626-287-3527
 Armoloy Co. 204 E. Daggett St. Ft. Worth, TX. 76104 332-5604 FAX: 817-335-6517
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 Armor (See Buck Stop Lure Co., Inc.)
 Armor Metal Products, P. O. Box 4609, Helena, MT 59604 406-442-5560; FAX: 406-442-5650
 Armory Publications, Inc., 2615 N. 4th St., No. 620, Coeur d'Alene, ID 83814-3781 208-664-5061; FAX: 208-664-9906
 Armoury, Inc., The, Rt. 202, Box 2340, New Preston, CT 06777 860-868-0001; FAX: 860-868-2919
 A.R.M.S., Inc., 230 W. Center St., West Bridgewater, MA 02379-1620 508-584-7816; FAX: 508-588-8045
 Arms & Armour Press, Wellington House, 125 Strand, London WC2R 0BB ENGLAND 0171-420-5555; FAX: 0171-240-7265
 Arms Corporation of the Philippines, Bo. Parang Marikina, Metro Manila, PHILIPPINES 632-941- 6243, 632-941-6244; FAX: 632-942-0682
 Arms Craft Gunsmithing, 1106 Linda Dr., Arroyo Grande, CA 93420 805-481-2830
 Arms Ingenuity Co., P. O. Box 1, 51 Canal St., Weatogue, CT 06089 203-658-5624
 Arms, Programming Solutions (See Arms Software)
 Arms Software, P. O. Box 1526, Lake Oswego, OR 97035 800-366-5559, 503-697-0533; FAX: 503-697- 3337
 Arms United Corp., 1018 Cedar St., Niles, MI 49120 616-683-6837
 Armscorp USA, Inc., 4424 John Ave., Baltimore, MD 21227 410-247-6200; FAX: 410-247-6205
 Armsport, Inc., 3950 NW 49th St., Miami, FL 33142 305-635-7850; FAX: 305-633-2877
 Arnold Arms Co., Inc., P. O. Box 1011, Arlington, WA 98223 800-371-1011, 360-435-1011; FAX: 360-435- 7304
 Aro-Tek, Ltd., 206 Frontage Rd. North, Suite C, Pacific, WA 98047 206-351-2984; FAX: 206-833-4483
 Arratoonian, Andy (See Horseshoe Leather Products)
 Arrieta, S. L., Morkaiko, 5, 20870 Elgoibar, SPAIN 34- 43-743150; FAX: 34-43-743154 (U. S. importers— Griffin & Howe; Jansma, Jack J.; New England Arms Co.; The Orvis Co., Inc.; Quality Arms, Inc.; Wingshooting Adventures)
 Art Jewel Enterprises Ltd., Eagle Business Ctr., 460 Randy Rd., Carol Stream, IL 60188 708-260-0400
 Art's Gun & Sport Shop, Inc., 6008 Hwy. Y, Hillsboro, MO 63050
 Artistry in Leather (See Stuart, V. Pat)
 Artistry in Wood, 134 Zimmerman Rd., Kalispell, MT 59901 406-257-9003
 Arundel Arms & Ammunition, Inc., A., 24A Defense St., Annapolis, MD 21401 410-224-8683
 Ashby Turkey Calls, P. O. Box 1466, Ava, MO 65608- 1466 417-967-3787
 Aspen Outfitting Co., 520 East Cooper Ave., Aspen, CO 81611
 A-Square Co., Inc., One Industrial Park, Bedford, KY 40006-9667 502-255-7456; FAX: 502-255-7657
 Astra Sport, S. A., Apartado 3, 48300 Guernica, Espagne, SPAIN 34-4-6250100; FAX: 34-4-6255186 (U. S. importer—E. A. A. Corp.; P. S. M. G. Gun Co.)
 Atamec-Bretton, 19, rue Victor Grignard, F-42026 St. - Etienne (Cedex 1) FRANCE 77-93-54-69; FAX: 33- 77-93-57-98 (U. S. importer—Mandall Shooting Supplies, Inc.)
 A-Tech Corp., P. O. Box 1281, Cottage Grove, OR 97424
 Atlanta Cutlery Corp., 2143 Gees Mill Rd., Box 839 CIS, Conyers, GA 30207 800-883-0300; FAX: 404- 388-0246
 Atlantic Mills, Inc., 1295 Towbin Ave., Lakewood, NJ 08701-5934 800-242-7374
 Atlantic Research Marketing Systems (See A. R. M. S., Inc.)
 Atlantic Rose, Inc., P. O. Box 1305, Union, NJ 07083
 Atsko Sno-Seal, Inc., 2530 Russell SE, Orangeburg, SC 29115 803-531-1820; FAX: 803-531-2139
 Audette, Creighton, 19 Highland Circle, Springfield, VT 05156 802-885-2331
 Austin's Calls, Bill, Box 284, Kaycee, WY 82639 307- 738-2552
 Autauga Arms, Inc., Pratt Plaza Mall No. 13, Prattville, AL 36067 800-262-9563; FAX: 334-361-2961
 Auto Arms, 738 Clearview, San Antonio, TX 78228 512-434-5450
 Automatic Equipment Sales, 627 E. Railroad Ave., Salesburg, MD 21801
 Auto-Ordnance Corp., Williams Lane, West Hurley, NY 12491 914-679-4190
 Autumn Sales, Inc. (Blaser), 1320 Lake St., Fort Worth, TX 76102 817-335-1634; FAX: 817-338-0119
 AWC Systems Technology, P. O. Box 41938, Phoenix, AZ 85080-1938 602-780-1050
 AYA (See U. S. importer—New England Custom Gun Service)
 A Zone Bullets, 2039 Walter Rd., Billings, MT 59105 252-3111; 406-248-1961
 Aztec International Ltd., P. O. Box 2616, Clarkesville, GA 30523 706-754-8282; FAX: 706-754-6889

B

B&D Trading Co., Inc., 3935 Fair Hill Rd., Fair Oaks, CA 95628 800-334-3790, 916-967-9366; FAX: 916- 967-4873
 B&G Bullets (See Northside Gun Shop)
 Badger Shooters Supply, Inc., P. O. Box 397, Owen, WI 54460 800-424-9069; FAX: 715-229-2332
 Baekgaard Ltd., 1855 Janke Dr., Northbrook, IL 60062 708-498-3040; FAX: 708-493-3106

Baelder, Harry, Alte Goennebeker Strasse 5, 24635 Rickling, GERMANY 04328-722732; FAX: 04328- 722733
 Baer Custom, Les, Inc., 29601 34th Ave., Hillside, IL 61257 309-658-2716; FAX: 309-658-2610
 Baer's Hollows, P. O. Box 284, Eads, CO 81036 719- 438-5718
 Bagmaster Mfg., Inc., 2731 Sutton Ave., St. Louis, MO 63143 314-781-8002; FAX: 314-781-3363; WEB: <http://www.bagmaster.com>
 Bain & Davis, Inc., 307 E. Valley Blvd., San Gabriel, CA 91776-3522 818-573-4241, 213-283-7449
 Baker, Stan, 10,000 Lake City Way, Seattle, WA 98125 206-522-4575
 Baker's Leather Goods, Roy, P. O. Box 893, Magnolia, AR 71753 501-234-0344
 Balaance Co., 340-39 Ave. S. E. Box 505, Calgary, AB, T2G 1X6 CANADA
 Bald Eagle Precision Machine Co., 101-A Allison St., Lock Haven, PA 17745 717-748-6772; FAX: 717- 748-4443
 Balickie, Joe, 408 Trelawney Lane, Apex, NC 27502
 919-362-5185
 Ballard Built, P. O. Box 1443, Kingsville, TX 78364 512-592-0853
 Ballard Industries, 10271 Lockwood Dr., Suite B, Cupertino, CA 95014 408-996-0957; FAX: 408-257- 6828
 Ballistic Engineering & Software, Inc., 185 N. Park Blvd., Suite 330, Lake Orion, MI 48362 313-391- 1074
 Ballistic Products, Inc., 20015 75th Ave. North, Corcoran, MN 55340-9456 612-494-9237; FAX: 612- 494-9236
 Ballistic Program Co., Inc., The, 2417 N. Patterson St., Thomasville, GA 31792 912-228-5739, 800-368- 0835
 Ballistic Research, 1108 W. May Ave., McHenry, IL 60050 815-385-0037
 Ballistica Maximus North, 107 College Park Plaza, Johnstown, PA 15904 814-266-8380
 Ballisti-Cast, Inc., Box 383, Parshall, ND 58770 701- 862-3324; FAX: 701-862-3331
 Bandcor Industries, Div. of Man-Sew Corp., 6108 Sherwin Dr., Port Richey, FL 34668 813-848-0432
 Bang-Bang Boutique (See Holster Shop, The)
 Banks, Ed, 2762 Hwy. 41 N., Ft. Valley, GA 31030 912-987-4665
 Bansner's Gunsmithing Specialties, 261 East Main St. Box VH, Adamstown, PA 19501 800-368-2379; FAX: 717-484-0523
 Barami Corp., 6689 Orchard Lake Rd. No. 148, West Bloomfield, MI 48322 810-738-0462; FAX: 810-855- 4084
 Barbour, Inc., 55 Meadowbrook Dr., Milford, NH 03055 603-673-1313; FAX: 603-673-6510
 Barnes Bullets, Inc., P. O. Box 215, American Fork, UT 84003 801-756-4222, 800-574-9200; FAX: 801-756- 2465; WEB:
<http://www.itsnet.com/home/bbullets>
 Baron Technology, 62 Spring Hill Rd., Trumbull, CT 06611 203-452-0515; FAX: 203-452-0663
 Barraclough, John K., 55 Merit Park Dr., Gardena, CA 90247 310-324-2574
 Barramundi Corp., P. O. Drawer 4259, Homosassa Springs, FL 32687 904-628-0200
 Barrett Firearms Manufacturer, Inc., P. O. Box 1077, Murfreesboro, TN 37133 615-896-2938; FAX: 615- 896-7313
 Barsotti, Bruce (See River Road Sporting Clays)
 Bar-Sto Precision Machine, 73377 Sullivan Rd., P. O. Box 1838, Twentynine Palms, CA 92277 619-367- 2747; FAX: 619-367-2407
 Barta's Gunsmithing, 10231 US Hwy. 10, Cato, WI 54206 414-732-4472
 Barteaux Machete, 1916 SE 50th Ave., Portland, OR 97215-3238 503-233-5880
 Bartlett, Don, P. O. Box 55, Colbert, WA 99005 509- 467-5009
 Bartlett Engineering, 40 South 200 East, Smithfield, UT 84335-1645 801-563-5910
 Basics Information Systems, Inc., 1141 Georgia Ave., Suite 515, Wheaton, MD 20902 301-949-1070; FAX: 301-949-5326
 Bates Engraving, Billy, 2302 Winthrop Dr., Decatur, AL 35603 205-355-3690
 Bauer, Eddie, 15010 NE 36th St., Redmond, WA 98052
 Baumgartner Bullets, 3011 S. Alane St., W. Valley City, UT 84120
 Bausch & Lomb Sports Optics Div. (See Bushnell Sports Optics Worldwide)
 Bauska Barrels, 105 9th Ave. W., Kalispell, MT 59901 406-752-7706
 Bear Archery, RR 4, 4600 Southwest 41st Blvd., Gainesville, FL 32601 904-376-2327
 Bear Arms, 121 Rhodes St., Jackson, SC 29831 803- 471-9859
 Bear Hug Grips, Inc., P. O. Box 16649, Colorado Springs, CO 80935-6649 800-232-7710
 Bear Mountain Gun & Tool, 120 N. Plymouth, New Plymouth, ID 83655 208-278-5221; FAX: 208-278- 5221
 Beartooth Bullets, P. O. Box 491, Dept. HLD, Dover, ID 83825-0491 208-448-1865
 Beauchamp & Son, Inc., 160 Rossiter Rd., P. O. Box 181, Richmond, MA 01254 413-698-3822; FAX: 413-698-3866
 Beaver Lodge (See Fellowes, Ted)
 Beaver Park Products, Inc., 840 J St., Penrose, CO 81240 719-372-6744
 BEC, Inc., 1227 W. Valley Blvd., Suite 204, Alhambra, CA 91803 818-281 -5751; FAX: 818-293-7073

Beeline Custom Bullets Limited, P. O. Box 85, Yarmouth, Nova Scotia CANADA B5A 4B1 902- 648-3494; FAX: 902-648-0253
 Beeman Precision Airguns, 5454 Argosy Dr., Huntington Beach, CA 92649 714-890-4800; FAX: 714-890-4808
 Behlert Precision, Inc., P. O. Box 288, 7067 Easton Rd., Pipersville, PA 18947 215-766-8681, 215-766-7301; FAX: 215-766-8681
 Beitzinger, George, 116-20 Atlantic Ave., Richmond Hill, NY 11419 718-847-7661
 Belding's Custom Gun Shop, 10691 Sayers Rd., Munith, MI 49259 517-596-2388
 Bell & Carlson, Inc., Dodge City Industrial Park 101 Allen Rd., Dodge City, KS 67801 800-634-8586, 316- 225-6688; FAX: 316-225-9095
 Bell Alaskan Silversmith, Sid (See Heritage Wildlife Carvings)
 Bell Reloading, Inc., 1725 Harlin Lane Rd., Villa Rica, GA 30180
 Bell's Gun & Sport Shop, 3309-19 Mannheim Rd, Franklin Park, IL 60131
 Bell's Legendary Country Wear, 22 Circle Dr., Bellmore, NY 11710 516-679-1158
 Bellm Contenders, P. O. Box 459, Cleveland, UT 84518 801-653-2530
 Belltown, Ltd., 11 Camps Rd., Kent, CT 06757 860- 354-5750
 Belt MTN Arms, 107 10th Ave. SW, White Sulphur Springs, MT 59645 406-586-4495
 Ben's Machines, 1151 S. Cedar Ridge, Duncanville, TX 75137 214-780-1807; FAX: 214-780-0316
 Benchmark Guns, 12593 S. Ave. 5 East, Yuma, AZ 85365
 Benchmark Knives (See Gerber Legendary Blades)
 Benelli Armi, S. p. A., Via della Stazione, 61029 Urbino, ITALY 39-722-307-1; FAX: 39-722-327427 (U. S. importers—Heckler & Koch, Inc.; Whitestone Lumber Co.)
 Bengtson Arms Co., L., 6345-B E. Akron St., Mesa, AZ 85205 602-981-6375
 Benjamin Sheridan Co., Crossman, Rts. 5 and 20, E. Bloomfield, NY 14443 716-657-6161; FAX: 716- 657-5405
 Bentley, John, 128-D Watson Dr., Turtle Creek, PA 15145
 Beomat of America Inc., 300 Railway Ave., Campbell, CA 95008 408-379-4829
 Beretta S. p. A., Pietro, Via Beretta, 18-25063 Gardone V. T. (BS) ITALY XX39 30-8341. 1; FAX: XX39 30- 8341. 421 (U. S. importer—Beretta U. S. A. Corp.)
 Beretta U. S. A. Corp., 17601 Beretta Drive, Accokeek, MD 20607 301-283-2191; FAX: 301-283-0435
 Berger Bullets, Ltd., 5342 W. Camelback Rd., Suite 200, Glendale, AZ 85301 602-842-4001; FAX: 602- 934-9083
 Bergman & Williams, 2450 Losee Rd., Suite F, Las Vegas, NV 89030 702-642-1901; FAX: 702-642- 1540
 Bernardelli S. p. A., Vincenzo, 125 Via Matteotti, P. O. Box 74, Gardone V. T., Brescia ITALY, 25063 39-30- 8912851-2-3; FAX: 39-30-8910249 (U. S. importer— Armsport, Inc.)
 Berry's Bullets (See Berry's Mfg., Inc.)
 Berry's Mfg., Inc., 401 North 3050 East St., St. George, UT 84770 801-634-1682; FAX: 801-634-1683
 Bersa S. A., Gonzales Castillo 312, 1704 Ramos Mejia, ARGENTINA 541-656-2377; FAX: 541-656-2093 (U. S. importer—Eagle Imports, Inc.)
 Bertram Bullet Co., P. O. Box 313, Seymour, Victoria 3660, AUSTRALIA 61-57-922912; FAX: 61-57- 991650
 Bertuzzi (See U. S. importer—New England Arms Co.)
 Better Concepts Co., 663 New Castle Rd., Butler, PA 16001 412-285-9000
 Beverly, Mary, 3201 Horseshoe Trail, Tallahassee, FL 32312
 Bianchi International, Inc., 100 Calle Cortez, Temecula, CA 92590 909-676-5621; FAX: 909-676-6777
 Biesen, Al, 5021 Rosewood, Spokane, WA 99208 509- 328-9340
 Biesen, Roger, 5021 W. Rosewood, Spokane, WA 99208 509-328-9340
 Big Beam Emergency Systems, Inc., 290 E. Prairie St., Crystal Lake, IL 60039
 Big Bear Arms & Sporting Goods, Inc., 1112 Milam Way, Carrollton, TX 75006 972-416-8051, 800-400- BEAR; FAX: 972-416-0771
 Big Bore Bullets of Alaska, P. O. Box 872785, Wasilla, AK 99687 907-373-2673; FAX: 907-373-2673
 Big Bore Express, 7154 W. State St., Boise, ID 83703 800-376-4010; FAX: 208-376-4020
 Big Sky Racks, Inc., P. O. Box 729, Bozeman, MT 59771-0729 406-586-9393; FAX: 406-585-7378
 Big Spring Enterprises "Bore Stores", P. O. Box 1115, Big Spring, Rd. Yellville, AR 72687 501-449-5297; FAX: 501-449-4446;
 E-MAIL: BIGSPRNG@mtnhome.com
 Bilal, Mustafa, 908 NW 50th St., Seattle, WA 98107- 3634 206-782-4164
 Bill's Custom Cases, P. O. Box 2, Dunsmuir, CA 96025 916-235-0177; FAX: 916-235-4959
 Bill's Gun Repair, 1007 Burlington St., Mendota, IL 61342 815-539-5786
 Billeb, Stephen L., 1101 N. 7th St., Burlington, IA 52601 319-753-2110
 Billings Gunsmiths, Inc., 1841 Grand Ave., Billings, MT 59102 406-256-8390
 Billingsley & Brownell, P. O. Box 25, Dayton, WY 82836 307-655-9344

Birchwood Casey, 7900 Fuller Rd., Eden Prairie, MN 55344 800-328-6156, 612-937-7933; FAX: 612-937- 7979
 Birdsong & Assoc., W. E., 1435 Monterey Rd., Florence, MS 39073-9748 601-366-8270
 Bismuth Cartridge Co., 3500 Maple Ave., Suite 1650, Dallas, TX 75219 800-759-3333, 214-521-5880; FAX: 214-521-9035
 Bison Studios, 1409 South Commerce St., Las Vegas, NV 89102 702-388-2891; FAX: 702-383-9967
 Bitterroot Bullet Co., Box 412, Lewiston, ID 83501 - 0412 208-743-5635
 Black Belt Bullets (See Big Bore Express)
 Black Hills Ammunition, Inc., P. O. Box 3090, Rapid City, SD 57709-3090 605-348-5150; FAX: 605-348- 9827
 Black Hills Shooters Supply, P. O. Box 4220, Rapid City, SD 57709 800-289-2506
 Black Powder Products, 67 Township Rd. 1411, Chesapeake, OH 45619 614-867-8047
 Black Sheep Brand, 3220 W. Gentry Parkway, Tyler, TX 75702 903-592-3853; FAX: 903-592-0527
 Blackhawk East, Box 2274, Loves Park, IL 61131
 Blackhawk West, Box 285, Hiawatha, KS 66434
 Blackinton & Co., Inc., V. H., 221 John L. Dietsch, Attleboro Falls, MA 02763-0300 508-699-4436; FAX: 508-695-5349
 Blackjack Knives, Ltd., 1307 W. Wabash, Effingham, IL 62401 217-347-7700; FAX: 217-347-7737
 Blacksmith Corp., 830 N. Road No. 1 E., P. O. Box 1752, Chino Valley, AZ 86323 520-636-4456; FAX: 520-636-4457
 BlackStar AccuMax Barrels, 11501 Brittmoore Park Drive, Houston, TX 77041 281 -721 -6040; FAX: 281 - 721-6041
 BlackStar Barrel Accurizing (See BlackStar AccuMax Barrels)
 Blacktail Mountain Books, 42 First Ave. W., Kalispell, MT 59901 406-257-5573
 Blair Engraving, J. R., P. O. Box 64, Glenrock, WY 82637 307-436-8115
 Blammo Ammo, P. O. Box 1677, Seneca, SC 29679 803-882-1768
 Blaser Jagdwaffen GmbH, D-88316 Isny Im Allgau, GERMANY (U. S. importer—Autumn Sales, Inc.)
 Bleile, C. Roger, 5040 Ralph Ave., Cincinnati, OH 45238 513-251-0249
 Blocker Holsters, Inc., Ted., Clackamas Business Park Bid. A, 14787 S. E. 82nd, Dr. Clackamas, OR 97015 503-557-7757; FAX: 503-557-3771
 Blount, Inc., Sporting Equipment Div., 2299 Snake River Ave., P. O. Box 856, Lewiston, ID 83501 800-3640, 208-746-2351; FAX: 208-799-3904
 Blue and Gray Products, Inc. (See Ox-Yoke Originals, Inc.)
 Blue Book Publications, Inc., One Appletree Square, 8009 34th Ave. S., Suite, 175 Minneapolis, MN 55425 800-877-4867, 612-854-5229; FAX: 612-853-1486
 Blue Mountain Bullets, HCR 77, P. O. Box 231, John Day, OR 97845 541-820-4594
 Blue Ridge Machinery & Tools, Inc., P. O. Box 536-GD, Hurricane, WV 25526 800-872-6500; FAX: 304-562- 5311
 BMC Supply, Inc., 26051 - 179th Ave. S. E., Kent, WA 98042 M. F. Activator, Inc., 803 Mill Creek Run, Plantersville, TX 77363 409-894-2005, 800-527- 2881
 Bob's Gun Shop, P. O. Box 200, Royal, AR 71968 501-767-1970
 Bob's Tactical Indoor Shooting Range & Gun Shop, 122 Lafayette Rd., Salisbury, MA 01952 508-465- 5561
 Boessler, Erich, Am Vogeltal 3, 97702 Munnerstadt, GERMANY 9733-9443
 Boggs, Wm., 1816 Riverside Dr. C, Columbus, OH 43212 614-486-6965
 Bohemia Arms Co., 17101 Los Modelos, Fountain Valley, CA 92708 619-442-7005; FAX: 619-442- 7005
 Boker USA, Inc., 1550 Balsam Street, Lakewood, CO 80215 303-462-0662; FAX: 303-462-0668
 Boltin, John M., P. O. Box 644, Estill, SC 29918 803- 625-2185
 Bo-Mar Tool & Mfg. Co., Rt. 8, Box 405, Longview, TX 75604 903-759-4784; FAX: 903-759-9141
 Bonanza (See Forster Products)
 Bond Arms, Inc., P. O. Box 1296, Granbury, TX 76048 573-5733; FAX: 817-573-5636
 Bond Custom Firearms, 8954 N. Lewis Ln., Bloomington, IN 47408 812-332-4519
 Bondini Paolo, Via Sorrento, 345, San Carlo di Cesena, ITALY 1-47020 0547 663 240; FAX: 0547 663 780 (U. S. importer—blackpowder arms)
 Bone Engraving, Ralph, 718 N. Atlanta, Owasso, OK 74055 918-272-9745
 Boone Trading Co., Inc., P. O. Box BB, Brinnan, WA 98320
 Boone's Custom Ivory Grips, Inc., 562 Coyote Rd., Brinnon, WA 98320 206-796-4330
 Boonie Packer Products, P. O. Box 12204, Salem, OR 97309 800-477-3244, 503-581-3244; FAX: 503-581- 3191
 Borden's Accuracy, RD 1, Box 250BC, Springville, PA 18844 717-965-2505; FAX: 717-965-2328
 Border Barrels Ltd., Riccarton Farm, Newcastleton SCOTLAND U. K. TD9 0SN
 Borovnik KG, Ludwig, 9170 Ferlach, Bahnhofstrasse 7, AUSTRIA 042 27 24 42; FAX: 042 26 43 49
 Bosis (See U. S. importer—New England Arms Co.)

Boss Manufacturing Co., 221 W. First St., Kewanee, IL 61443 309-852-2131, 800-447-4581; FAX: 309-852- 0848
 Bostick Wildlife Calls, Inc., P. O. Box 728, Estill, SC 29918 803-625-2210, 803-625-4512
 Bowen Classic Arms Corp., P. O. Box 67, Louisville, TN 37777 423-984-3583
 Bowen Knife Co., Inc., P. O. Box 590, Blackshear, GA 31516 912-449-4794
 Bowerly, Kent, 26247 Metolius Meadows Dr., Camp Sherman, OR 97730 541-595-6028
 Boyds' Gunstock Industries, Inc., 3rd & Main, P. O. Box 305, Geddes, SD 57342 605-337-2125; FAX: 605- 337-3363
 Boyt, 509 Hamilton, P. O. Drawer 668, Iowa Falls, IA 50126 515-648-4626; FAX: 515-648-2385
 Brace, Larry D., 771 Blackfoot Ave., Eugene, OR 97404 503-688-1278
 Bradley Gunsight Co., P. O. Box 340, Plymouth, VT 05056 860-589-0531; FAX: 860-582-6294
 Brass and Bullet Alloys, P. O. Box 1238, Sierra Vista, AZ 85636 602-458-5321; FAX: 602-458-9125
 Brass Eagle, Inc., 7050A Bramalea Rd., Unit 19, Mississauga, Ont. L4Z 1C7, CANADA 416-848-4844
 Bratcher, Dan, 311 Belle Air Pl., Carthage, MO 64836 417-358-1518
 Brauer Bros. Mfg. Co., 2020 Delman Blvd., St. Louis, MO 63103 314-231-2864; FAX: 314-249-4952
 Braverman Corp., R. J., 88 Parade Rd., Meridith, NH 03293 800-736-4867
 Break-Free, Inc., P. O. Box 25020, Santa Ana, CA 92799 714-953-1900; FAX: 714-953-0402
 Brenneke KG, Wilhelm, Ilmenauweg 2, 30851 Langenhagen, GERMANY 0511 97262-0; FAX: 0511 97262-62 (U. S. importer—Dynamit Nobel-RWS, Inc.)
 Bretton (See Atamec-Bretton)
 Bridgers Best, P. O. Box 1410, Berthoud, CO 80513
 Brieze Bullet Co., Inc., RR1, Box 108, Tappen, ND 58487 701-327-4578; FAX: 701-327-4579
 Brigade Quartermasters, 1025 Cobb International Blvd., Dept. VH, Kennesaw, GA 30144-4300 404-428- 1248, 800-241-3125; FAX: 404-426-7726
 Briganti, A. J., 512 Rt. 32, Highland Mills, NY 10930 914-928-9573
 Briley Mfg., Inc., 1230 Lumpkin, Houston, TX 77043 800-331-5718, 713-932-6995; FAX: 713-932-1043
 British Antiques, P. O. Box 7, Latham, NY 12110 518- 783-0773
 British Sporting Arms, RR1, Box 130, Millbrook, NY 12545 914-677-8303
 BRNO (See U. S. importers—Bohemia Arms Co.)
 Broad Creek Rifle Works, 120 Horsey Ave., Laurel, DE 19956 302-875-5446
 Brobst, Jim, 299 Poplar St., Hamburg, PA 19526 215-562-2103
 Brockman's Custom Gunsmithing, P. O. Box 357, Gooding, ID 83330 208-934-5050
 Brocock Ltd., 43 River Street, Digbeth, Birmingham, B5 5SA ENGLAND 011-021-773-1200
 Broken Gun Ranch, 10739 126 Rd., Spearville, KS 67876 316-385-2587; FAX: 316-385-2597
 Brolin Arms, 2755 Thompson Creek Rd., Pomona, CA 91767 909-392-2350; FAX: 909-392-2354
 Brooker, Dennis, Rt. 1, Box 12A, Derby, LA 50068 515-533-2103
 Brooks Tactical Systems, 279-A Shorewood Ct., Fox Island, WA 98333 800-410-4747; FAX: 206-572- 6797
 Brown Co., E. Arthur, 3404 Pawnee Dr., Alexandria, MN 56308 320-762-8847
 Brown, H. R. (See Silhouette Leathers)
 Brown Dog Ent., 2200 Calle Camelia, 1000 Oaks, CA 91360 805-497-2318; FAX: 805-497-1618
 Brown Manufacturing, P. O. Box 9219, Akron, OH 44305 800-837-GUNS
 Brown Precision, Inc., 7786 Molinos Ave., Los Molinos, CA 96055 916-384-2506; FAX: 916-384- 1638
 Brown Products, Inc., Ed, Rt. 2, Box 492, Perry, MO 63462 573-565-3261; FAX: 573-565-2791
 Brownell Checkering Tools, W. E., 9390 Twin Mountain Circle, San Diego, CA 92126 619-695- 2479; FAX: 619-695-2479
 Brownells, Inc., 200 S. Front St., Montezuma, IA 50171 515-623-5401; FAX: 515-623-3896
 Browning Arms Co., One Browning Place, Morgan, UT 84050 801 -876-2711; FAX: 801 -876-3331
 Browning Arms Co. (Parts & Service), 3005 Arnold Tenbrook Rd., Arnold, MO 63010-9406 314-287- 6800; FAX: 314-287-9751
 BRP, Inc., High Performance Cast Bullets, 1210 Alexander Rd., Colorado Springs, CO 80909 719- 633-0658
 Bruno Shooters Supply, 111 N. Wyoming St., Hazleton, PA 18201 717-455-2281; FAX: 717-455-2211
 Brunton U. S. A., 620 E. Monroe Ave., Riverton, WY 82501 307-856-6559; FAX: 307-856-1840
 Brynin, Milton, P. O. Box 383, Yonkers, NY 10710 914-779-4333
 BSA Guns Ltd., Armoury Rd. Small Heath, Birmingham, ENGLAND B11 2PX 011-021-772- 8543; FAX: 011-021-773-0845 (U. S. importers—Groenewold, John; Precision Sales International, Inc.)
 B-Square Company, Inc., P. O. Box 11281, 2708 St. Louis Ave., Ft. Worth, TX 76110 817-923-0964, 800- 433-2909; FAX: 817-926-7012
 Bucheimer, J. M., Jumbo Sports Products, 721 N. 20th St., St. Louis, MO 63103 314-241-1020
 Buck Knives, Inc., 1900 Weld Blvd., P. O. Box 1267, El Cajon, CA 92020 619-449-1100, 800-326-2825; FAX: 619-562-5774, 800-729-2825

Buck Stix—SOS Products Co., Box 3, Neenah, WI 54956
 Buck Stop Lure Co., Inc., 3600 Grow Rd. NW, P. O. Box 636, Stanton, MI 48888 517-762-5091; FAX: 517-762-5124
 Buckeye Custom Bullets, 6490 Stewart Rd., Elida, OH 45807 419-641-4463
 Buckhorn Gun Works, 8109 Woodland Dr., Black Hawk, SD 57718 605-787-6472
 Buckskin Bullet Co., P. O. Box 1893, Cedar City, UT 84721 801-586-3286
 Buckskin Machine Works, A. Hunkeler, 3235 S. 358th St., Auburn, WA 98001 206-927-5412
 Budin, Dave, Main St., Margaretville, NY 12455 914- 568-4103; FAX: 914-586-4105
 Buenger Enterprises Goldenrod Dehumidifier, 3600 S. Harbor Blvd., Oxnard, CA 93035 800-451-6797, 805- 985-5828; FAX: 805-985-1534
 Buffalo Arms Co., 3355 Upper Gold Creek Rd., Samuels, ID 83864 208-263-6953; FAX: 208-265- 2096
 Buffalo Bullet Co., Inc., 12637 Los Nietos Rd., Unit A, Santa Fe Springs, CA 90670 310-944-0322; FAX: 310-944-5054
 Buffalo Rock Shooters Supply, R. R. 1, Ottawa, IL 61350 815-433-2471
 Buffer Technologies, P. O. Box 104930, Jefferson City, MO 65110 573-634-8529; FAX: 573-634-8522
 Bull Mountain Rifle Co., 6327 Golden West Terrace, Billings, MT 59106 406-656-0778
 Bullberry Barrel Works, Ltd., 2430 W. Bullberry Ln. 67-5, Hurricane, UT 84737 801-635-9866; FAX: 801-635-0348
 Bullet, Inc., 3745 Hiram Alworth Rd., Dallas, GA 30132
 Bullet'n Press, 19 Key St., Eastport, Maine 04631 207- 853-4116
 Bullet Swaging Supply, Inc., P. O. Box 1056, 303 McMillan Rd, West Monroe, LA 71291 318-387- 7257; FAX: 318-387-7779
 BulletMakers Workshop, The, RFD 1 Box 1755, Brooks, ME 04921
 Bullseye Bullets, 1610 State Road 60, No. 12, Valrico, FL 33594 813-654-6563
 Bull-X, Inc., 520 N. Main, Farmer City, IL 61842 309- 928-2574, 800-248-3845 orders only; FAX: 309-928- 2130
 Burgess, Byron, P. O. Box 6853, Los Osos, CA 93412 805-528-1005
 Burgess & Son Gunsmiths, R. W., P. O. Box 3364, Warner Robins, GA 31099 912-328-7487
 Burkhart Gunsmithing, Don, P. O. Box 852, Rawlins, WY 82301 307-324-6007
 Burnham Bros., P. O. Box 1148, Menard, TX 78659 396-4572; FAX: 915-396-4574
 Burres, Jack, 10333 San Fernando Rd., Pacoima, CA 91331 818-899-8000
 Burris Co., Inc., P. O. Box 1747, 331 E. 8th St., Greeley, CO 80631 970-356-1670; FAX: 970-356-8702
 Bushmann Hunters & Safaris, P. O. Box 293088, Lewisville, TX 75029 214-317-0768
 Bushmaster Firearms (See Quality Parts Co. Bushmaster Firearms)
 Bushmaster Hunting & Fishing, 451 Alliance Ave., Toronto, Ont. M6N 2J1 CANADA 416-763-4040; FAX: 416-763-0623
 Bushnell Sports Optics Worldwide, 9200 Cody, Overland Park, KS 66214 913-752-3400, 800-423- 3537; FAX: 913-752-3550
 Bushwacker Backpack & Supply Co. (See Counter Assault)
 Bustani, Leo, P. O. Box 8125, W. Palm Beach, FL 33407 305-622-2710
 Buster's Custom Knives, P. O. Box 214, Richfield, UT 84701 801-896-5319
 Butler Creek Corp., 290 Arden Dr., Belgrade, MT 800-423-8327, 406-388-1356; FAX: 406-388- 7204
 Butler Enterprises, 834 Oberting Rd., Lawrenceburg, IN 47025 812-537-3584
 Butterfield & Butterfield, 220 San Bruno Ave., San Francisco, CA 94103 415-861-7500
 Buzztail Brass (See Grayback Wildcats)
 B-West Imports, Inc., 2425 N. Huachuca Dr., Tucson, AZ 85745-1201 602-628-1990; FAX: 602-628-3602

C

C3 Systems, 678 Killingly St., Johnston, RI 02919
 C&D Special Products (See Claybuster Wads & Harvester Bullets)
 C&H Research, 115 Sunnyside Dr., Box 351, Lewis, KS 67552 316-324-5445
 C&J Enterprises, Inc., 7101 Jurupa Ave., No. 12, Riverside, CA 92504 909-689-7758
 C&T Corp. TA Johnson Brothers, 1023 Wappoo Road, Charleston, SC 29407-5960
 Cabanas (See U. S. importer—Mandall Shooting Supplies, Inc.)
 Cabela's, 812-13th Ave., Sidney, NE 69160 308-254- 6644, 800-237-4444; FAX: 308-254-6745
 Cabinet Mtn. Outfitters Scents & Lures, P. O. Box 766, Plains, MT 59859 406-826-3970
 Cache La Poudre Rifleworks, 140 N. College, Ft. Collins, CO 80524 303-482-6913
 Cadre Supply (See Parts & Surplus)
 Calhoon Varmint Bullets, James, Shambo Rt., 304, Havre, MT 59501 406-395-4079
 Calibre Press, Inc., 666 Dundee Rd., Suite 1607, Northbrook, IL 60062-2760 800-323-0037; FAX: 708-498-6869
 Cali'co Hardwoods, Inc., 3580 Westwind Blvd., Santa Rosa, CA 95403 707-546-4045; FAX: 707-546-4027

Calico Light Weapon Systems, 405 E. 19th St., Bakersfield, CA 93305 805-323-1327; FAX: 805- 323-7844
 California Magnum, 20746 Dearborn St., Chatsworth, CA 91313 818-341-7302; FAX: 818-341-7304
 California Sights (See Fautheree, Andy)
 Camdex, Inc., 2330 Alger, Troy, MI 48083 810-528- 2300; FAX: 810-528-0989
 Cameron's, 16690 W. 11th Ave., Golden, CO 80401 303-279-7365; FAX: 303-628-5413
 Camilli, Lou, 600 Sandtree Dr., Suite 212, Lake Park, FL 33403-1538
 Camillus Cutlery Co., 54 Main St., Camillus, NY 13031 672-8 111; FAX: 315-672-8832
 Campbell, Dick, 20,000 Silver Ranch Rd., Conifer, CO 80433 303-697-0150
 Camp-Cap Products, P. O. Box 173, Chesterfield, MO 63006 314-532-4340; FAX: 314-532-4340
 Canjar Co., M. H., 500 E. 45th Ave., Denver, CO 80216? 295-2638; FAX: 303-295-2638
 Cannon's, Andy Cannon, Box 1026, 320 Main St., Poison, MT 59860 406-887-2048
 Cannon Safe, Inc., 9358 Stephens St., Pico Rivera, CA 90660 310-692-0636, 800-242-1055; FAX: 310-692- 7252
 Canons Delcour, Rue J. B. Cools, B-4040 Herstal, BELGIUM 32. (0)42. 40. 61. 40; FAX: 32(0)42. 40. 22. 88
 Canyon Cartridge Corp., P. O. Box 152, Albertson, NY 11507 FAX: 516-294-8946
 Cape Outfitters, 599 County Rd. 206, Cape Girardeau, MO 63701 314-335-4103; FAX: 314-335-1555
 Caraville Manufacturing, P. O. Box 4545, Thousand Oaks, CA 91359 805-499-1234
 Carbide Checkering Tools (See J&R Engineering)
 Carbide Die & Mfg. Co., Inc., 15615 E. Arrow Hwy., Irwindale, CA 91706 818-337-2518
 Carhartt, Inc., P. O. Box 600, 3 Parklane Blvd., Dearborn, MI 48121 800-358-3825, 313-271-8460; FAX: 313-271-3455
 Custom Gun Engraving, D-97422 Schweinfurt, Siedlerweg 17, GERMANY 01149-9721-41446; FAX: 01149-9721-44413
 Carlson, Douglas R., Antique American Firearms, P. O. Box 71035, Dept. GD, Des Moines, IA 50325 515- 224-6552
 Carnahan Bullets, 17645 110th Ave. SE, Renton, WA 98055
 Carolina Precision Rifles, 1200 Old Jackson Hwy., Jackson, SC 29831 803-827-2069
 Carrell's Precision Firearms, 643 Clark Ave., Billings, MT 59101-1614 406-962-3593
 Carroll Bullets (See Precision Reloading, Inc.)
 Carry-Lite, Inc., 5203 W. Clinton Ave., Milwaukee, WI 53223 414-355-3520; FAX: 414-355-4775
 Carter's Gun Shop, 225 G St., Penrose, CO 81240 719- 372-6240
 Carter's Wildlife Calls, Inc., Garth, P. O. Box 821, Cedar City, UT 84720 801-586-7639
 Cartridge Transfer Group, Pete de Coux, 235 Oak St., Butler, PA 16001 412-282-3426
 Carvajal Belts & Holsters, 422 Chestnut, San Antonio, TX 78202 210-222-1634
 Cascade Bullet Co., Inc., 2355 South 6th St., Klamath Falls, OR 97601 503-884-9316
 Cascade Shooters, 2155 N. W. 12th St., Redwood, OR 97756
 Case & Sons Cutlery Co., W. R., Owens Way, Bradford, PA 16701 814-368-4123, 800-523-6350; FAX: 814-768-5369
 Case Sorting System, 12695 Cobblestone Creek Rd., Poway, CA 92064 619-486-9340
 Cash Mfg. Co., Inc., P. O. Box 130, 201 S. Klein Dr., Waunakee, WI 53597-0130 608-849-5664; FAX: 608-849-5664
 Caspian Arms Ltd., 14 North Main St., Hardwick, VT 05843 802-472-6454; FAX: 802-472-6709
 Cast Performance Bullet Company, 12441 U. S. Hwy. 26, Riverton, WY 82501 307-856-4347
 Casull Arms Corp., P. O. Box 1629, Afton, WY 83110 307-886-0200
 Caswell International Corp., 1221 Marshall St. NE, Minneapolis, MN 55413-1055 612-379-2000; FAX: 612-379-2367
 Catco-Ambush, Inc., P. O. Box 300, Corte Madera, CA 94926
 Cathey Enterprises, Inc., P. O. Box 2202, Brownwood, TX 76804 915-643-2553; FAX: 915-643-3653
 Cation, 2341 Alger St., Troy, MI 48083 810-689-0658; FAX: 810-689-7558
 Catocin Cutlery, P. O. Box 188, 17 S. Main St., Smithsburg, MD 21783 301-824-7416; FAX: 301- 824-6138
 Cay wood, Shane J., P. O. Box 321, Minocqua, WI 54548 277-3866 evenings
 CBC, Avenida Humberto de Campos, 3220, 09400-000 Ribeirao Pires-SP-BRAZIL 55-11-742-7500; FAX: 55-11-459-7385
 CCG Enterprises, 5217 E. Belknap St., Halton City, TX 76117 800-819-7464
 CCI, Div. of Blount, Inc., Sporting Equipment Div., 2299 Snake River Ave., P. O. Box 856 Lewiston, ID 83501 800-627-3640, 208-746-2351; FAX: 208-746-2915
 Cedar Hill Game Calls, Inc., Rt. 2 Box 236, Downsview, LA 71234 318-982-5632; FAX: 318-368-2245
 Celestron International, P. O. Box 3578, 2835 Columbia St., Torrance, CA 90503 310-328-9560; FAX: 310- 212-5835
 Centaur Systems, Inc., 1602 Foothill Rd., Kalispell, MT 59901 406-755-8609; FAX: 406-755-8609

Center Lock Scope Rings, 9901 France Ct., Lakeville, MN 55044 612-461-2114
CenterMark, P. O. Box 4066, Parnassus Station, New Kensington, PA 15068 412-335-1319
Central Specialties Ltd. (See Trigger Lock Division Central Specialties Ltd.)
Century Gun Dist., Inc., 1467 Jason Rd., Greenfield, IN 46140 317-462-4524
Century International Arms, Inc., P. O. Box 714, St. Albans, VT 05478-0714 802-527-1252, 800-527- 1252; FAX: 802-527-0470;
WEB: tp: www.centuryarms.com
CFVentures, 509 Harvey Dr., Bloomington, IN 47403- 1715
C-H Tool & Die Corp. (See 4-D Custom Die Co.)
CHAA, Ltd., P. O. Box 565, Howell, MI 48844 800- 677-8737; FAX: 313-894-6930
Chace Leather Products, 507 Alden St., Fall River, MA 02722 508-678-7556; FAX: 508-675-9666
Chadick's Ltd., P.O. Box 100, Terrell, TX 75160 214-563-7577
Chambers Flintlocks Ltd., Jim, Rt. 1, Box 513-A, Candler, NC 28715 704-667-8361
Champion Shooters' Supply, P.O. Box 303, New Albany, OH 43054 614-855-1603; FAX: 614-855- 1209
Champion Target Co., 232 Industrial Parkway, Richmond, IN 47374 800-441-4971
Champion's Choice, Inc., 201 International Blvd., LaVergne, TN 37086 615-793-4066; FAX: 615-793- 4070
Champlin Firearms, Inc., P.O. Box 3191, Woodring Airport, Enid, OK 73701 405-237-7388; FAX: 405- 242-6922
Chapman Academy of Practical Shooting, 4350 Academy Rd., Hallsville, MO 65255 573-696-5544, 573-696-2266
Chapman Manufacturing Co., 471 New Haven Rd., P.O. Box 250, Durham, CT 06422 203-349-9228; FAX: 203-349-0084
Chapuis Armes, 21 La Gravoux, BP15,42380 St. Bonnet-le-Chateau, FRANCE (33)77.50.06.96 (U.S. importer—Champlin Firearms, Inc.; Chapuis USA)
Chapuis USA, 416 Business Park, Bedford, KY 40006
Checkmate Refinishing, 370 Champion Dr., Brooksville, FL 34601 904-799-5774
Cheddite France, S.A., 99, Route de Lyon, F-26501 Bourg-les-Valence, FRANCE 33-75-56-4545; FAX: 33-75-56-3587
Chelsea Gun Club of New York City, Inc., 237 Ovington Ave., Apt. D53, Brooklyn, NY 11209 718- 836-9422, 718-833-2704
Chem-Pak, Inc., 11 Oates Ave., P.O. Box 1685, Winchester, VA 22604 800-336-9828, 703-667-1341; FAX: 703-722-3993
Cherry's Fine Guns, P.O. Box 5307, Greensboro, NC 27435-0307 919-854-4182
Chesapeake Importing & Distributing Co. (See CIDCO) CheVron Bullets, RR1, Ottawa, IL 61350 815-433- 2471
CheVron Case Master (See CheVron Bullets)
Chicago Cutlery Co., 1536 Beech St., Terre Haute, IN 47804 800-457-2665
Chicasaw Gun Works, 4 Mi. Mkr., Pluto Rd., Box 868, Shady Spring, WV 25918-0868 304-763-2848; FAX: 304-763-2848
Chippmunk (See Oregon Arms, Inc.)
Chippewa Shoe Co., P.O. Box 2521, Ft. Worth, TX 76113 817-332-4385
Choate Machine & Tool Co., Inc., P.O. Box 218,116 Lovers Ln., Bald Knob, AR 72010 501-724-6193, 800-972-6390; FAX: 501-724-5873
Chopie Mfg., Inc., 700 Copeland Ave., LaCrosse, WI V 54603 608-784-0926
Christensen Arms, 192 East 100 North, Fayette, UT 84630 801-528-7999; FAX: 801-528-7494
Christie's East, 219 E. 67th St., New York, NY 10021 212-606-0400
Christman Jr., David, Gunmaker, 937 Lee Hedrick Rd., Colville, WA 99114 509-684-1438
Christopher Firearms Co., Inc., E., Route 128 & Ferry St., Miamitown, OH 45041 513-353-1321
Chu Tani Ind., Inc., P.O. Box 2064, Cody, WY 82414- 2064
Chuck's Gun Shop, P.O. Box 597, Waldo, FL 32694 904-468-2264 Churchill (See U.S. importer—Ellett Bros.)
Churchill, Winston, Twenty Mile Stream Rd., RFD P.O. Box 29B, Proctorsville, VT 05153 802-226-7772
Churchill Glove Co., James, P.O. Box 298, Centralia, WA 98531
CIDCO, 21480 Pacific Blvd., Sterling, VA 22170 703- 444-5353
Ciener, Inc., Jonathan Arthur, 8700 Commerce St., Cape Canaveral, FL 32920 407-868-2200; FAX: 407- 868-2201
Cimarron Arms, P.O. Box 906, Fredericksburg, TX 78624-0906 210-997-9090; FAX: 210-997-0802
Cincinnati Swaging, 2605 Marlinton Ave., Cincinnati, OH 45208
Citadel Mfg., Inc., 5220 Gabbert Rd., Moorpark, CA 93021 805-529-7294; FAX: 805-529-7297
J. Ballistics, Inc., P.O. Box 132, Acme, WA 98220 206-595-5001
Clark Co., Inc., David, P.O. Box 15054, Worcester, MA 01615-0054 508-756-6216; FAX: 508-753-5827
Clark Custom Guns, Inc., 336 Shootout Lane, Princeton, LA 71067 318-949-9884; FAX: 318-949- 9829
Clark Firearms Engraving, P.O. Box 80746, San Marino, CA 91118 818-287-1652

Clarkfield Enterprises, Inc., 1032 10th Ave., Clarkfield, MN 56223 612-669-7140
 Claro Walnut Gunstock Co., 1235 Stanley Ave., Chico, CA 95928 916-342-5188
 Classic Arms Corp., P.O. Box 106, Dunsmuir, CA 96025-0106 916-235-2000
 Classic Guns, Inc., Frank S. Wood, 3230 Medlock Bridge Rd., Suite 110, Norcross, GA 30092 404-242- 7944
 Claybuster Wads & Harvester Bullets, 309 Sequoya Dr., Hopkinsville, KY 42240 800-922-6287, 800-284- 1746, 502-885-8088;
 FAX: 502-885-1951
 Clearview Mfg. Co., Inc., 413 S. Oakley St., Fordyce, AR 71742 501-352-8557; FAX: 501-352-7120
 Clearview Products, 3021 N. Portland, Oklahoma City, OK 73107
 Cleland's Gun Shop, Inc., 10306 Airport Hwy., Swanton, OH 43558 419-865-4713
 Clements' Custom Leathercraft, Chas, 1741 Dallas St., Aurora, CO 80010-2018 303-364-0403; FAX:303-739-9824
 Clenzoil Corp., P.O. Box 80226, Sta. C, Canton, OH 44708-0226 330-833-9758; FAX: 330-833-4724
 Clerke Co., J.A., P.O. Box 627, Pearblossom, CA 93553-0627 805-945-0713
 Clift Mfg., L.R., 3821 Hammonton Rd., Marysville, CA 95901 916-755-3390; FAX: 916-755-3393
 Clift Welding Supply & Cases, 1332-A Colusa Hwy., Yuba City, CA 95993 916-755-3390; FAX: 916-755- 3393
 Cloward's Gun Shop, 4023 Aurora Ave. N, Seattle, WA 98103 206-632-2072
 Clymer Manufacturing Co., Inc., 1645 W. Hamlin Rd., Rochester Hills, MI 48309-1530 810-853-5555, 810- 853-5627; FAX: 810-853-1530
 C-More Systems, P.O. Box 1750, 7553 Gary Rd., Manassas, VA 22110 703-361-2663; FAX: 703-361- 5881
 Coats, Mrs. Lester, 300 Luman Rd., Space 125, Phoenix, OR 97535 503-535-1611
 Cobalt Mfg., Inc., 1020 Shady Oak Dr., Denton, TX 76205 817-382-8986; FAX: 817-383-4281
 Cobra Sport S.r.l., Via Caduti Nei Lager No. 1, 56020 San Romano, Montopoli v Amo (Pi), ITALY 0039- 571-450490; FAX: 0039-571-450492
 Coffin, Charles H., 3719 Scarlet Ave., Odessa, TX 79762 915-366-4729
 Coffin, Jim (See Working Guns)
 Cogar's Gunsmithing, P.O. Box 755, Houghton Lake, MI 48629 517-422-4591
 Coghlan's Ltd., 121 Irene St., Winnipeg, Man., CANADA R3T 4C7 204-284-9550; FAX: 204-475- 4127
 Cold Steel, Inc., 2128-D Knoll Dr., Ventura, CA 93003 800-255-4716,800-624-2363 (in CA); FAX: 805-642- 9727
 Cole's Gun Works, Old Bank Building, Rt. 4, Box 250, Moyock, NC 27958 919-435-2345 Cole-Grip, 16135 Cohasset St., Van Nuys, CA 91406 818-782-4424
 Coleman Co., Inc., 250 N. St. Francis, Wichita, KS 67201
 Coleman's Custom Repair, 4035 N. 20th Rd., Arlington, VA 22207 703-528-4486
 Collings, Ronald, 1006 Cielta Linda, Vista, CA 92083
 Colonial Arms, Inc., P.O. Box 636, Selma, AL 36702- 0636 334-872-9455; FAX: 334-872-9540
 Colonial Knife Co., Inc., P.O. Box 3327, Providence, RI 02909 401-421-1600; FAX: 401-421-2047
 Colonial Repair, P.O. Box 372, Hyde Park, MA 02136- 9998 617-469-4951
 Colorado Gunsmithing Academy, 27533 Highway 287 South, Lamar, CO 81052 719-336-4099, 800-754- 2046; FAX: 719-336-9642
 Colorado School of Trades, 1575 Hoyt St., Lakewood, CO 80215 800-234-4594; FAX: 303-233-4723
 Colorado Shooter's Supply, 1163 W. Paradise Way, Fruita, CO 81521 303-858-9191
 Colorado Sutlers Arsenal (See Cumberland States Arsenal)
 Colt Blackpowder Arms Co., 110 8th Street, Brooklyn, NY 11215 212-925-2159; FAX: 212-966-4986
 Colt's Mfg. Co., Inc., P.O. Box 1868, Hartford, CT 06144-1868 8(X)-962-COLT, 203-236-6311; FAX: 203-244-1449
 Combat Military Ordnance Ltd., 3900 Hopkins St., Savannah, GA 31405 912-238-1900; FAX: 912-236- 7570
 Companhia Brasileira de Cartuchos (See CBC) Compass Industries, Inc., 104 East 25th St., New York, NY 10010 212-473-2614, 800-221-9904; FAX: 212- 353-0826
 Compasseco, Ltd., 151 Atkinson Hill Ave., Bardtown, KY 40004 502-349-0910
 Competition Electronics, Inc., 3469 Precision Dr., Rockford, IL 61109 815-874-8001; FAX: 815-874- 8181
 Competitive Pistol Shop, The, 5233 Palmer Dr., Ft. Worth, TX 76117-2433 817-834-8479
 Competitor Corp., Inc., Appleton Business Center, 30 Tricnit Road, Unit 16, New Ipswich, NH 03071-0508 878-3891; FAX: 603-878-3950
 Component Concepts, Inc., 10240 SW Nimbus Ave., Suite L-8, Portland, OR 97223 503-684-9262; FAX: 503-620-4285
 Concept Development Corp., 14715 N. 78th Way, Suite 300, Scottsdale, AZ 85260 800-472-4405; FAX: 602- 948-7560
 Condon, Inc., David, 109 E. Washington St., Middleburg, VA 22117 703-687-5642
 Conetrol Scope Mounts, 10225 Hwy. 123 S., Seguin, TX 78155 210-379-3030, 800-CONETROL; FAX: 210-379-3030

CONKKO, P.O. Box 40, Broomall, PA 19008 215-356- 0711
 Connecticut Shotgun Mfg. Co., P.O. Box 1692, 35 Woodland St., New Britain, CT 06051-1692 860-225- 6581; FAX: 860-832-8707
 Connecticut Valley Classics (See CVC)
 Conrad, C.A., 3964 Ebert St., Winston-Salem, NC 27127 919-788-5469
 Continental Kite & Key (See CONKKO)
 Cook Engineering Service, 891 Highbury Rd., Vermont VICT 3133 AUSTRALIA
 Coonan Arms (JS Worldwide DBA), 1745 Hwy. 36 E., Maplewood, MN 55109 612-777-3156; FAX: 612- 777-3683
 Cooper Arms, P.O. Box 114, Stevensville, MT 59870 406-777-5534; FAX: 406-777-5228
 Cooper-Woodward, 3800 Pelican Rd., Helena, MT 59602 406-458-3800
 Copperhead Bullets, Inc., P.O. Box 662, Butte, MT 59703 406-723-6300
 Corbin Mfg. & Supply, Inc., 600 Industrial Circle, P.O. Box 2659, White City, OR 97503 541-826-5211; FAX: 541-826-8669
 Cor-Bon Bullet & Ammo Co., 1311 Industry Rd., Sturgis, SD 57785 800-626-7266; FAX: 800-923- 2666
 Corkys Gun Clinic, 4401 Hot Springs Dr., Greeley, CO 80634-9226 970-330-0516
 Corry, John, 861 Princeton Ct., Neshanic Station, NJ 08853 908-369-8019
 Cosmi Americo & Figlio s.n.c., Via Flaminia 307, Ancona, ITALY 1-60020 071-888208; FAX: 39-071- 887008 (U.S. importer—New England Arms Co.)
 Costa, David (See Island Pond Gun Shop)
 Coulston Products, Inc., P.O. Box 30, 201 Ferry St., Suite 212, Easton, PA 18044-0030 215-253-0167, 800-445-9927; FAX: 215-252-1511
 Counter Assault, Box 4721, Missoula, MT 59806 406- 728-6241; FAX: 406-728-8800
 Country Armourer, The, P.O. Box .308, Ashby, MA 01431-0308 508-827-6797; FAX: 508-827-4845
 Cousin Bob's Mountain Products, 7119 Ohio River Blvd., Ben Avon, PA 15202 412-766-5114; FAX: 412-766-5114
 Cox, Ed C., RD 2, Box 192, Prosperity, PA 15329 412- 228-4984
 CP Bullets, 340-1 Constance Dr., Warminster, PA 18974
 CQB Training, P.O. Box 1739, Manchester, MO 63011
 Craftguard, 3624 Logan Ave., Waterloo, IA 50703 319- 232-2959; FAX: 319-234-0804
 Craig Custom Ltd., Research & Development, 629 E. 10th, Hutchinson, KS 67501 316-669-0601
 Crandall Tool & Machine Co., 19163 21 Mile Rd., Tustin, MI 49688 616-829-4430
 Crane & Crane Ltd., 105 N. Edison Way 6, Reno, NV 89502-2355 702-856-1516; FAX: 702-856-1616
 Crane Sales Co., George S., P.O. Box 385, Van Nuys, CA 91408 818-505-8337
 CRDC Laser Systems Group, 3972 Barranca Parkway, Ste. J-484, Irvine, CA 92714 714-586-1295; FAX: 714-831-4823
 Creative Craftsman, Inc., The, 95 Highway 29 North, P.O. Box 331, Lawrenceville, GA 30246 404-963- 2112; FAX: 404-513-9488
 Creedmoor Sports, Inc., P.O. Box 1040, Oceanside, CA 92051 619-757-5529
 Creek Side Metal & Woodcrafters (See Allard, Gary)
 Creekside Gun Shop, Inc., Main St., Holcomb, NY 14469 716-657-6338; FAX: 716-657-7900
 Crimson Trace, 1433 N.W. Quimby, Portland, OR 97209 503-295-2406; 503-295-0005
 Crit'R Call (See Rocky Mountain Wildlife Products)
 Crosman Airguns, Rts. 5 and 20, E. Bloomfield, NY 14443 716-657-6161; FAX: 716-657-5405
 Crosman Blades (See Coleman Co., Inc.)
 Crosman Products of Canada Ltd., 1173 N. Service Rd. West, Oakville, Ontario, L6M 2V9 CANADA 905- 827-1822
 Crouse's Country Cover, P.O. Box 160, Storrs, CT 06268 860-423-8736
 CRR, Inc. Marble's Inc., 420 Industrial Park, P.O. Box 111, Gladstone, MI 49837 906-428-3710; FAX: 906- 428-3711
 Crucelegui, Hermanos (See U.S. importer—Mandall Shooting Supplies, Inc.)
 Cryo-Accurizing, 2101 East Olive, Decatur, IL 62526 423-3070; FAX: 217-423-3075
 Cubic Shot Shell Co., Inc., 98 Fatima Dr., Campbell, OH 44405 216-755-0349; FAX: 216-755-0349
 Cullity Restoration, Daniel, 209 Old County Rd., East Sandwich, MA 02537 508-888-1147
 Cumberland Arms, 514 Shafer Road, Manchester, TN 37355 800-797-8414
 Cumberland Knife & Gun Works, 5661 Bragg Blvd., Fayetteville, NC 28303 919-867-0009
 Cumberland Mountain Arms, P.O. Box 710, Winchester, TN 37398 615-967-8414; FAX: 615- 967-9199
 Cumberland States Arsenal, 1124 Palmyra Road, Clarksville, TN 37040
 Cummings Bullets, 1417 Esperanza Way, Escondido, CA 92027
 Cunningham Co., Eaton, 607 Superior St., Kansas City, MO 64106 816-842-2600
 Cupp, Alana, Custom Engraver, P.O. Box 207, Annabella, UT 84711 801 -896-4834
 Curly Maple Stock Blanks (See Tiger-Hunt)
 Curtis Custom Shop, RR1, Box 193 A, Wallingford, KY 41093 703-659-4265

Curtis Cast Bullets, 119 W. College, Bozeman, MT 406-587-4934
 Curtis Gun Shop (See Curtis Cast Bullets)
 Custom Barreling & Stocks, 937 Lee Hedrick Rd., Colville, WA 99114 509-684-5686 (days), 509-684- 3314 (evenings)
 Custom Bullets by Hoffman, 2604 Peconic Ave., Seaford, NY 11783
 Custom Calls, 607 N. 5th St., Burlington, IA 52601 319-752-4465
 Custom Checkering Service, Kathy Forster, 2124 SE Yamhill St., Portland, OR 97214 503-236-5874
 Custom Chronograph, Inc., 5305 Reese Hill Rd., Sumas, WA 98295 360-988-7801
 Custom Firearms (See Ahrends, Kim)
 Custom Gun Products, 5021 W. Rosewood, Spokane, WA 99208 509-328-9340
 Custom Gun Stocks, Rt. 6, P.O. Box 177, McMinnville, TN 37110 615-668-3912
 Custom Gunsmiths, 4303 Friar Lane, Colorado Springs, CO 80907 719-599-3366
 Custom Hunting Ammo & Arms (See CHAA, Ltd.)
 Custom Products (See Jones Custom Products, Neil A.)
 Custom Quality Products, Inc., 345 W. Girard Ave., P.O. Box 71129, Madison Heights, MI 48071 810- 585-1616; FAX: 810-585-0644
 Custom Riflestocks, Inc., Michael M. Kokolus, 7005 Herber Rd., New Tripoli, PA 18066 610-298-3013
 Custom Shop, The, 890 Cochrane Crescent, Peterborough, Ont. K9H 5N3 CANADA 705-742- 6693
 Custom Tackle and Ammo, P.O. Box 1886, Farmington, NM 87499 505-632-3539
 Cutco Cutlery, P.O. Box 810, Olean, NY 14760 716- 372-3111
 Cutlery Shoppe, 5461 Kendall St., Boise, ID 83706- 1248 800-231-1272
 Cutsinger Bench Rest Bullets, RR 8, Box 161-A, Shelbyville, IN 46176 317-729-5360
 CVA, 5988 Peachtree Corners East, Norcross, GA 30071 800-251 -9412; FAX: 404-242-8546
 CVC, 48 Commercial Street, Holyoke, MA 01040 413- 552-3184; FAX: 413-552-3276
 Cylinder & Slide, Inc., William R. Laughridge, 245 E. 4th St., Fremont, NE 68025 402-721-4277; FAX: 402-721-0263
 CZ USA, 40356 Oak Park Way, Suite W, Oakhurst, CA 93664

D

D&D Gunsmiths, Ltd., 363 E. Elmwood, Troy, MI 48083 810-583-1512; FAX: 810-583-1524
 D&G Precision Duplicators (See Greene Precision Duplicators)
 D&H Precision Tooling, 7522 Barnard Mill Rd., Ringwood, IL 60072 815-653-4011
 D&H Prods. Co., Inc., 465 Denny Rd., Valencia, PA 16059 412-898-2840, 800-776-0281; FAX: 412-898- 2013
 D&J Bullet Co. & Custom Gun Shop, Inc., 426 Ferry St., Russell, KY 41169 606-836-2663; FAX: 606- 836-2663
 D&L Industries (See D.J. Marketing)
 D&L Sports, P.O. Box 651, Gillette, WY 82717 307- 686-4008
 D&R Distributing, 308 S.E. Valley St., Myrtle Creek, OR 97457 503-863-6850
 Dade Screw Machine Products, 2319 NW 7th Ave., Miami, FL 33127 305-573-5050
 Daewoo Precision Industries Ltd., 34-3 Yeoeuido- Dong, Yeongdeungoo-GU, 15th, FI. Seoul, KOREA (U.S. importer—Nationwide Sports Distributors, Inc.) Daisy Mfg. Co., P.O. Box 220, Rogers, AR 72757 501 - 1200; FAX: 501-636-1601
 Dakota (See U.S. importer—EMF Co., Inc.)
 Dakota Arms, Inc., HC 55, Box 326, Sturgis, SD 57785 605-347-4686; FAX: 605-347-4459
 Dakota Corp., 77 Wales St., P.O. Box 543, Rutland, VT 05701 802-775-6062, 800-451-4167; FAX: 802-773- 3919
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 DAMASCUS-U.S.A., 149 Deans Farm Rd., Tyner, NC 27980 919-221-2010; FAX: 919-221-2009
 Dan's Whetstone Co., Inc., 130 Timbs Place, Hot Springs, AR 71913 501-767-1616; FAX: 501-767- 9598
 Dangler, Homer L., Box 254, Addison, MI 49220 517-547-6745
 Danner Shoe Mfg. Co., 12722 NE Airport Way, Portland, OR 97230 503-251-1100, 800-345-0430; FAX: 503-251-1119
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 Datumtech Corp., 2275 Wehrle Dr., Buffalo, NY 14221
 Dave's Gun Shop, 555 Wood Street, Powell, Wyoming 82435 307-754-9724
 Davidson, Jere, Rt. 1, Box 132, Rustburg, VA 24588 804-821-3637
 Davis, Don, 1619 Heights, Katy, TX 77493 713-391- 3090
 Davis Co., R.E., 3450 Pleasantville NE, Pleasantville, OH 43148 614-654-9990

Davis Industries, 15150 Sierra Bonita Ln., Chino, CA 91710 909-597-4726; FAX: 909-393-9771
 Davis Leather Co., Gordon Wm., P.O. Box 2270, Walnut, CA 91788 909-598-5620
 Davis Products, Mike, 643 Loop Dr., Moses Lake, WA 98837 509-765-6178, 509-766-7281 orders only
 Davis Service Center, Bill, 7221 Florin Mall Dr., Sacramento, CA 95823 916-393-4867
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 Dayson Arms Ltd., P.O. Box 532, Vincennes, IN 47591 812-882-8680; FAX: 812-882-8680
 Daystate Ltd., Birch House Lane, Cotes Heath, Staffs, ST15.022 ENGLAND 01782-791755; FAX: 01782-791617
 Dayton Traister, 4778 N. Monkey Hill Rd., P.O. Box 593, Oak Harbor, WA 98277 360-679-4657; FAX: 360-675-1114
 DBASE Consultants (See Arms, Peripheral Data Systems)
 DBI Books, Division of Krause Publications, (Editorial office) 935 Lakeview Parkway, Suite 101, Vernon Hills, IL 60061
 847-573-8530; FAX: 847-573-8534; For consumer orders, see Krause Publications
 D-Boone Ent., Inc., 5900 Colwyn Dr., Harrisburg, PA 17109
 D.C.C. Enterprises, 259 Wynbum Ave., Athens, GA 30601
 D.D. Custom Stocks, R.H. "Dick" Devereaux, 5240 Mule Deer Dr., Colorado Springs, CO 80919 719-548-8468
 de Coux, Pete (See Cartridge Transfer Group) de Treville & Co., Stan, 4129 Normal St., San Diego, CA 92103 619-298-3393
 Dead Eye's Sport Center, RD 1, Box 147B, Shickshinny, PA 18655 717-256-7432
 Decker Shooting Products, 1729 Laguna Ave., Schofield, WI 54476 715-359-5873
 DeckSlider of Florida, 27641-2 Reahard Ct., Bonita Springs, FL 33923 800-782-1474
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 011-91-121-511599
 Deer Me Products Co., Box 34, 1208 Park St., Anoka, MN 55303 612-421-8971; FAX: 612-422-0526
 Defense Training International, Inc., 749 S. Lemay, Ste. A3-337, Ft. Collins, CO 80524 303-482-2520; FAX: 303-482-0548
 Degen Inc. (See Aristocrat Knives) deHaas Barrels, RR 3, Box 77, Ridgeway, MO 64481 816-872-6308
 Del Rey Products, P.O. Box 91561, Los Angeles, CA 90009 213-823-0494
 Delhi Gun House, 1374 Kashmere Gate, Delhi, INDIA 110 006 (011)2940974 2940814; FAX: 91-11-2917344
 Delorge, Ed, 2231 Hwy. 308, Thibodaux, LA 70301 504-447-1633
 Del-Sports, Inc., Box 685, Main St., Margaretville, NY 12455 914-586-4103; FAX: 914-586-4105
 Delta Arms Ltd., P.O. Box 1000, Delta, VT 84624-1000
 Delta Enterprises, 284 Hagemann Drive, Livermore, CA 94550
 Delta Frangible Ammunition, LLC, P.O. Box 2350, Stafford, VA 22555-2350 540-720-5778, 800-339-1933; FAX: 540-720-5667
 Dem-Bart Checkering Tools, Inc., 6807 Bickford Ave., Old Hwy. 2, Snohomish, WA 98290 360-568-7356; FAX: 360-568-1798
 Denver Bullets, Inc., 1811 W. 13th Ave., Denver, CO 80204 303-893-3146; FAX: 303-893-9161
 Denver Instrument Co., 6542 Fig St., Arvada, CO 80004 800-321-1135, 303-431-7255; FAX: 303-423-4831
 DeSantis Holster & Leather Goods, Inc., P.O. Box 2039, 149 Denton Ave., New Hyde Park, NY 11040-0701 516-354-8000; FAX: 516-354-7501
 Desert Mountain Mfg., P.O. Box 2767, Columbia Falls, MT 59912 800-477-0762, 406-892-7772
 Detroit-Armor Corp., 720 Industrial Dr. No. 112, Cary, IL 60013 708-639-7666; FAX: 708-639-7694
 Dever Co., Jack, 8590 NW 90, Oklahoma City, OK 73132 405-721-6393
 Devereaux, R.H. "Dick" (See D.D. Custom Stocks)
 Dewey Mfg. Co., Inc., J., P.O. Box 2014, Southbury, CT 06488 203-264-3064; FAX: 203-262-6907
 DGR Custom Rifles, RR 1, Box 8A, Tappen, ND 58487 701-327-8135
 DGS, Inc., Dale A. Storey, 1117 E. 12th, Casper, WY 82601 307-237-2414
 DHB Products, P.O. Box 3092, Alexandria, VA 22302 703-836-2648
 Diamond Machining Technology (See DMT—Diamond Machining Technology)
 Diamond Mfg. Co., P.O. Box 174, Wyoming, PA 18644 800-233-9601
 Diana (See U.S. importer—Dynamit Nobel-RWS, Inc.)
 Dibble, Derek A., 555 John Downey Dr., New Britain, CT 06051 203-224-2630
 Dietz Gun Shop & Range, Inc., 421 Range Rd., New Braunfels, TX 78132 210-885-4662
 Dilliot Gunsmithing, Inc., 657 Scarlett Rd., Dandridge, TN 37725 423-397-9204
 Dillon, Ed, 1035 War Eagle Dr. N., Colorado Springs, CO 80919 719-598-4929; FAX: 719-598-4929
 Dillon Precision Products, Inc., 8009 East Dillon's Way, Scottsdale, AZ 85260 602-948-8009, 800-762-3845; FAX: 602-998-2786
 Dina Arms Corporation, P.O. Box 46, Royersford, PA 19468 610-287-0266; FAX: 610-287-0266
 Division Lead Co., 7742 W. 61st Pl., Summit, IL 60502

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 Dixon Muzzleloading Shop, Inc., RD 1, Box 175, Kempton, PA 19529 610-756-6271
 D.J. Marketing, 10602 Horton Ave., Downey, CA 90241 310-806-0891; FAX: 310-806-6231
 DKT, Inc., 14623 Vera Drive, Union, MI 49130-9744 616-641-7120, 800-741-7083 orders only; FAX: 616- 641-2015
 DLO Mfg., 10807 SE Foster Ave., Arcadia, FL 33821- 7304
 D-Max, Inc., RR1, Box 473, Bagley, MN 56621 218- 785-2278
 DMT—Diamond Machining Technology, Inc., 85 Hayes Memorial Dr., Marlborough, MA 01752 508-5944; FAX: 508-485-3924
 Doctor Optic Technologies, Inc., 4685 Boulder Highway, Suite A, Las Vegas, NV 89121 800-290- 3634, 702-898-7161; FAX: 702-898-3737
 Dogtown Varmint Supplies, 1048 Irvine Ave. No. 333, Newport Beach, CA 92660 714-642-3997
 Dohring Bullets, 100 W. 8 Mile Rd., Femdale, MI 48220
 Dolbare, Elizabeth, P.O. Box 222, Sunburst, MT 59482- 0222
 Donnelly, C.P., 405 Kubli Rd., Grants Pass, OR 97527 541-846-6604
 Doskocil Mfg. Co., Inc., P.O. Box 1246, 4209 Barnett, Arlington, TX 76017 817-467-5116; FAX: 817-472- 9810
 Double A Ltd., P.O. Box 11306, Minneapolis, MN 55411 612-522-0306
 Douglas Barrels, Inc., 5504 Big Tyler Rd., Charleston, WV 25313-1398 304-776-1341; FAX: 304-776-8560
 Downsizer Corp., P.O. Box 710316, Santee, CA 92072- 0316 619 448-5510; FAX: 619-448-5780
 Downton Gunworks, Rt. 4, Box 930A, Flagstaff, AZ 86001 602-779-1898
 Dr. O's Products Ltd., P.O. Box 111, Niverville, NY 12130 518-784-3333; FAX: 518-784-2800
 Drain, Mark, SE 3211 Kamilche Point Rd., Shelton, WA 98584 206-426-5452
 Dremel Mfg. Co., 4915-21st St., Racine, WI 53406
 Dressel Jr., Paul G., 209 N. 92nd Ave., Yakima, WA 98908 509-966-9233; FAX: 509-966-3365
 Dri-Slide, Inc., 411 N. Darling, Fremont, MI 49412 616-924-3950
 Dropkick, 1460 Washington Blvd., Williamsport, PA 17701 717-326-6561; FAX: 717-326-4950
 DTM International, Inc., 40 Joslyn Rd., P.O. Box 5, Lake Orion, MI 48362 313-693-6670
 Duane Custom Stocks, Randy, 110W. North Ave., Winchester, VA 22601 703-667-9461; FAX: 703-722-3993
 Duane's Gun Repair (See DGR Custom Rifles)
 Dubber, Michael W., P.O. Box 312, Evansville, IN 47702 812-424-9000; FAX: 812-424-6551
 Duck Call Specialists, P.O. Box 124, Jersey ville, IL 62052 618-498-9855
 Duffy (See Guns Antique & Modern DBA Charles E. Duffy)
 Du-Lite Corp., Charles E., 171 River Rd., Middletown, CT 06457 203-347-2505; FAX: 203-347-9404
 Dumoulin, Ernest, Rue Florent Boclinville 8-10, 13- 4041 Votten, BELGIUM 41 27 78 92 (U.S. importer—New England Arms Co.)
 Duncan's Gun Works, Inc., 1619 Grand Ave., San Marcos, CA 92069 619-727-0515
 Dunham Co., P.O. Box 813, Brattleboro, VT 05301 802-254-2316
 Dunphy, Ted, W. 5100 Winch Rd., Rathdrum, ID 83858 208-687-1399; FAX: 208-687-1399
 Duofold, Inc., RD 3 Rt. 309, Valley Square Mall, Tamaqua, PA 18252 717-386-2666; FAX: 717-386- 3652
 DuPont (See IMR Powder Co.)
 Dutchman's Firearms, Inc., The, 4143 Taylor Blvd., Louisville, KY 40215 502-366-0555
 Dybala Gun Shop, P.O. Box 1024, FM 3156, Bay City, TX 77414 409-245-0866
 Dykstra, Doug, 411 N. Darling, Fremont, MI 49412 616-924-3950
 Dynalite Products, Inc., 215 S. Washington St., , Greenfield, OH 45123 513-981-2124
 Dynamit Nobel-RWS, Inc., 81 Ruckman Rd., Closter, NJ 07624 201-767-7971; FAX: 201-767-1589
 Dyson & Son Ltd., Peter, 3 Cuckoo Lane, Honley, Huddersfield, Yorkshire HD7 2BR, ENGLAND 44- 1484-661062; FAX: 44-1484-663709

E

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 E.A.A. Corp., P.O. Box 1299, Sharpes, FL 32959 407- 639-4842, 800-536-4442; FAX: 407-639-7006
 Eagan, Donald V., P.O. Box 196, Benton, PA 17814 717-925-6134
 Eagle Arms (See ArmaLite, Inc.)
 Eagle Grips, Eagle Business Center, 460 Randy Rd., Carol Stream, IL 60188 800-323-6144, 708-260- 0400; FAX: 708-260-0486
 Eagle Imports, Inc., 1750 Brielle Ave., Unit B1, Wanamassa, NJ 07712 908-493-0333; FAX: 908- 493-0301
 Eagle International Sporting Goods, Inc., P.O. Box 67, Zap, ND 58580 888-932-4536; FAX: 701-948-2282
 E-A-R, Inc., Div. of Cabot Safety Corp., 5457 W. 79th St., Indianapolis, IN 46268 800-327-3431; FAX: 800- 488-8007

Eastman Products, R.T., P.O. Box 1531, Jackson, WY 83001 307-733-3217, 800-624-4311
 Easy Pull Outlaw Products, 316 1 st St. East, Poison, MT 59860 406-883-6822
 EAW (See U.S. importer—New England Custom Gun Service)
 Echols & Co., D'Arcy, 164 W. 580 S., Providence, UT 84332 801-753-2367
 Eclectic Technologies, Inc., 45 Grandview Dr., Suite A, Farmington, CT 06034
 Eckelman Gunsmithing, 3125 133rd St. SW, Fort Ripley, MN 56449 218-829-3176
 Ed's Gun House, P.O. Box 62, Minnesota City, MN 55959 507-689-2925
 Edenpine, Inc. c o Six Enterprises, Inc., 320 D Turtle Creek Ct., San Jose, CA 95125 408-999-0201; FAX: 408-999-0216
 EdgeCraft Corp. P.B. Tuminello, 825 Southwood Road, Avondale, PA 19311 610-268-0500, 800-342- 3255; FAX: 610-268-3545
 Edmisten Co., P.O. Box 1293, Boone, NC 28607
 Edmund Scientific Co., 101 E. Gloucester Pike, Barrington, NJ 08033 609-543-6250
 Ednar, Inc., 2-4-8 Kayabacho, Nihonbashi, Chuo-ku, Tokyo, JAPAN 103 81(Japan)-3-3667-1651; FAX: 81-3-3661-8113
 Eezox, Inc., P.O. Box 772, Waterford, CT 06385-0772 860-447-8282, 800-462-3331; FAX: 860-447-3484
 Effebe SNC-Dr. Franco Beretta, via Rossa, 4, 25062 Concesio, Italy 030-2751955; FAX: 030-2180414 (U.S. importer—Nevada Cartridge Co.)
 Eggleston, Jere D., 400 Saluda Ave., Columbia, SC 29205 803-799-3402
 EGW Evolution Gun Works, 4050 B-8 Skyron Dr., Doylestown, PA 18901 215-348-9892; FAX: 215- 348-1056
 Eichelberger Bullets, Wm., 158 Crossfield Rd., King of Prussia, PA 19406
 EK Knife Co., c o Blackjack Knives, Ltd., 1307 Wabash Ave., Effingham, IL 62401
 Ekol Leather Care, P.O. Box 2652, West Lafayette, IN 47906 317-463-2250; FAX: 317-463-7004
 El Dorado Leather (c o Dill), P.O. Box 566, Benson, AZ 85602 520-586-4791; FAX: 520-586-4791
 El Paso Saddlery Co., P.O. Box 27194, El Paso, TX 79926 915-544-2233; FAX: 915-544-2535
 Eldorado Cartridge Corp. (See PMC Eldorado Cartridge Corp.)
 Electro Prismatic Collimators, Inc., 1441 Manatt St., Lincoln, NE 68521
 Electronic Shooters Protection, Inc., 11997 West 85th Place, Arvada, CO 80005 303-456-8964; 800-797- 7791; FAX: 303-456-7179
 Electronic Trigger Systems, Inc., P.O. Box 13, 230 Main St. S., Hector, MN 55342 320-848-2760; FAX: 320-848-2760
 Eley Ltd., P.O. Box 705, Witton, Birmingham, B6 7UT, ENGLAND 021-356-8899; FAX: 021-331-4173
 Elite Ammunition, P.O. Box 3251, Oakbrook, IL 60522 708-366-9006
 Elk River, Inc., 1225 Paonia St., Colorado Springs, CO 80915 719-574-4407
 Elkhorn Bullets, P.O. Box 5293, Central Point, OR 97502 541-826-7440
 Ellett Bros., 267 Columbia Ave., P.O. Box 128, Chapin, SC 29036 803-345-3751, 800-845-3711; FAX: 803- 345-1820
 Ellicott Arms, Inc. Woods Pistolsmithing, 3840 Dahlgren Ct., Ellicott City, MD 21042 410-465-7979
 Elliott Inc., G.W., 514 Burnside Ave., East Hartford, CT 06108 203-289-5741; FAX: 203-289-3137
 Elsen, Inc., Pete, 1529 S. 113th St., West Allis, WI 53214
 Emerging Technologies, Inc. (See Laseraim Technologies, Inc.)
 EMF Co., Inc., 1900 E. Warner Ave. Suite 1-D, Santa Ana, CA 92705 714-261-6611; FAX: 714-756-0133
 Empire Cutlery Corp., 12 Kruger Ct., Clifton, NJ 07013 201-472-5155; FAX: 201-779-0759
 Engineered Accessories, 1307 W. Wabash Ave., Effingham, IL 62401 217-347-7700; FAX: 217-347- 7737
 English, Inc., A.G., 708 S. 12th St., Broken Arrow, OK 74012 918-251-3399
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 Engraving Artistry, 36 Alto Rd., RFD 2, Burlington, CT 06013 203-673-6837
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 Enhanced Presentations, Inc., 5929 Market St., Wilmington, NC 28405 910-799-1622; FAX: 910-799-5004
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 Ensign-Bickford Co., The, 660 Hopmeadow St., Simsbury, CT 06070
 EPC, 1441 Manatt St., Lincoln, NE 68521 402-476- 3946
 Epps, Ellwood (See "Gramps" Antique Cartridges)
 Erhardt, Dennis, 3280 Green Meadow Dr., Helena, MT 59601 406-442-4533
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 Erma Werke GmbH, Johan Ziegler St., 13 15 FeldiglSt., D-8060 Dachau, GERMANY (U.S. importers—Amtec 2000, Inc.; Mandall Shooting Supplies, Inc.)
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 Essex Metals, 1000 Brighton St., Union, NJ 07083 800- 282-8369
 Estate Cartridge, Inc., 12161 FM 830, Willis, TX 77378 856-7277; FAX: 409-856-5486
 Euber Bullets, No. Orwell Rd., Orwell, VT 05760 802- 948-2621
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 European American Armory Corp. (See E.A.A. Corp.)
 Eutaw Co., Inc., The, P.O. Box 608, U.S. Hwy. 176 West, Holly Hill, SC 29059 803-496-3341
 Evans, Andrew, 2325 NW Squire St., Albany, OR 97321 541 -928-3190; FAX: 541 -928-4128
 Evans Engraving, Robert, 332 Vine St., Oregon City, OR 97045 503-656-5693
 Evans Gunsmithing (See Evans, Andrew)
 Eversull Co., Inc., K., 1 Tracemont, Boyce, LA 71409 793-8728; FAX: 318-793-5483
 Excalibur Enterprises, P.O. Box 400, Fogelsville, PA 18051-0400 610-391-9105; FAX: 610-391-9220
 Exe, Inc., 18830 Partridge Circle, Eden Prairie, MN 55346 612-944-7662
 Executive Protection Institute, Rt. 2, Box 3645, Berryville, VA 22611 540-955-1128
 C. Eyears, Roland, 576 Binns Blvd., Columbus, OH 43204-2441
 Eyster Heritage Gunsmiths, Inc., Ken, 6441 Bishop Rd., Centerburg, OH 43011 614-625-6131
 Eze-Lap Diamond Prods., P.O. Box 2229, 15164 Weststate St., Westminster, CA 92683 714-847-1555; FAX: 714-897-0280
 E-Z-Way Systems, P.O. Box 4310, Newark, OH 43058- 4310 614-345-6645, 800-848-2072; FAX: 614-345- 6600

F

F&A Inc. (See ShurKatch Corporation)
 Fabarm S.p.A., Via Averolda 31, 25039 Travagliato, Brescia, ITALY 030-6863629; FAX: 030-6863684 (U.S. importer—Ithaca Gun Co., LLC)
 Fagan & Co., William, 22952 15 Mile Rd., Clinton Township, MI 48035 810-465-4637; FAX: 810-792- 6996
 Fair Game International, P.O. Box 77234-34053, Houston, TX 77234 713-941-6269
 F.A.I.R. Techni-Mec s.n.c. di Isidoro Rizzini & C., Via Gitti, 41 Zona I, dustriale 25060 Marcheno (Brescia), ITALY 030 861162-8610344; FAX: 030 8610179
 Faith Associates, Inc., 1139 S. Greenville Hwy., Hendersonville, NC 28792 704-692-1916; FAX: 704- 697-6827
 Fajen, Inc., Reinhart, Route 1, P.O. Box 214-A, Lincoln, MO 65338 816-547-3030; FAX: 816-547-2215
 Famas (See U.S. importer—Century International Arms, Inc.)
 Fanzoj GmbH, Griesgasse 1, 9170 Ferlach, AUSTRIA 9170 (43) 04227-2283; FAX: (43) 04227-2867
 Far North Outfitters, Box 1252, Bethel, AK 99559
 Farm Form Decoys, Inc., 1602 Biovu, P.O. Box 748, Galveston, TX 77553 409-744-0762, 409-765-6361; FAX: 409-765-8513
 Farmer-Dressel, Sharon, 209 N. 92nd Ave., Yakima, WA 98908 509-966-9233; FAX: 509-966-3365
 Farr Studio, Inc., 1231 Robinhood Rd., Greeneville, TN 37743 615-638-8825
 Farrar Tool Co., Inc., 12150 Bloomfield Ave., Suite E, Santa Fe Springs, CA 90670 310-863-4367; FAX: 310-863-5123
 FAS, Via E. Fermi, 8,20019 Settimo Milanese, Milano, ITALY 02-3285844; FAX: 02-33500196 (U.S. importer—Nygord Precision Products)
 Faulhaber Wildlocker, Dipl.-Ing. Norbert Wittasek, Seilergasse 2, A-1010 Wien, AUSTRIA OM-43-1- 5137001; FAX: OM-43-1-5137001
 Faulk's Game Call Co., Inc., 616 18th St., Lake Charles, LA 70601 318-436-9726
 Faust, Inc., T.G., 544 Minor St., Reading, PA 19602 610-375-8549; FAX: 610-375-4488
 Fausti Cav. Stefano & Figlie snc, Via Martiri Dell Indipendenza, 70, Marcheno, ITALY 25060 (U.S. importer—American Arms, Inc.)
 Fautheree, Andy, P.O. Box 4607, Pagosa Springs, CO 81157 303-731-5003
 Feather, Flex Decoys, 1655 Swan Lake Rd., Bossier City, LA 71 111 318-746-8596; FAX: 318-742-4815
 Federal Cartridge Co., 900 Ehlen Dr., Anoka, MN 55303 612-323-2300; FAX: 612-323-2506
 Federal Champion Target Co., 232 Industrial Parkway, Richmond, IN 47374 800-441-4971; FAX: 317-966- 7747
 Federated-Fry (See Fry Metals)
 FEG, Budapest, Soroksariut 158, H-1095 HUNGARY (U.S. importers—Century International Arms, Inc.; K.B.I., Inc.)
 Feinwerkbau Westinger & Altenburger GmbH (See FWB)
 Feken, Dennis, Rt. 2 Box 124, Perry, OK 73077 405- 336-5611
 Fellowes, Ted, Beaver Lodge, 9245 16th Ave. SW, Seattle, WA 98106 206-763-1698
 Feminine Protection, Inc., 10514 Shady Trail, Dallas, TX 75220 214-351-4500; FAX: 214-352-4686
 Ferdinand, Inc., P.O. Box 5,201 Main St., Harrison, ID 83833 208-689-3012, 800-522-6010 (U.S.A.), 800- 258-5266 (Canada); FAX: 208-689-3142
 Ferguson, Bill, P.O. Box 1238, Sierra Vista, AZ 85636 520-458-5321; FAX: 520-458-9125

FERLIB, Via Costa 46, 25063 Gardone V.T. (Brescia) ITALY 30-89-12-586; FAX: 30-89-12-586 (U.S. importer—Harry Marx)
 Ferris Firearms, 7110 F.M. 1863, Bulverde, TX 78163 210-980-4424
 Fibron Products, Inc., P.O. Box 430, Buffalo, NY 14209-0430 716-886-2378; FAX: 716-886-2394
 Finch Custom Bullets, 40204 La Rochelle, Prairieville, LA 70769
 Fiocchi Munizioni S.p.A. (See U.S. importer—Fiocchi of America, Inc.)
 Fiocchi of America, Inc., 5030 Fremont Rd., Ozark, MO 65721 417-725-4118, 800-721-2666; FAX: 417-725-1039
 Firearm Training Center, The, 9555 Blandville Rd., West Paducah, KY 42086 502-554-5886
 Firearms Academy of Seattle, P.O. Box 2814, Kirkland, WA 98083 206-820-4853
 Firearms Co. Ltd. Alpine (See U.S. importer—Mandall Shooting Supplies, Inc.)
 Firearms Engraver's Guild of America, 332 Vine St., Oregon City, OR 97045 503-656-5693
 Fire'n Five, P.O. Box 11 Granite Rt., Sumpter, OR 97877
 First, Inc., Jack, 1201 Turbine Dr., Rapid City, SD 57701 605-343-9544; FAX: 605-343-9420
 Fish Mfg. Gunsmith Sptg. Co., Marshall F., Rd. Box 2439, Rt. 22 North, Westport, NY 12993 518-962-4897
 Fisher, Jerry A., 553 Crane Mt. Rd., Big Fork, MT 59911 406-837-2722
 Fisher Custom Firearms, 2199 S. Kittredge Way, Aurora, CO 80013 303-755-3710
 Fisher Enterprises, Inc., 1071 4th Ave. S., Suite 303, Edmonds, WA 98020-4143 206-771-5382
 Fisher, R. Kermit (See Fisher Enterprises, Inc.)
 Fitz Pistol Grip Co., P.O. Box 610, Douglas City, CA 96024 916-778-0240
 Flaig's, 2200 Evergreen Rd., Millvale, PA 15209 412-821-1717
 Flambeau Products Corp., 15981 Valplast Rd., Middlefield, OH 44062 216-632-1631; FAX: 216-632-1581
 Flannery Engraving Co., Jeff W., 11034 Riddles Run Rd., Union, KY 41091 606-384-3127
 Flashette Co., 4725 S. Kolin Ave., Chicago, IL 60632 773-927-1302; FAX: 773-927-3083
 Flayderman & Co., Inc., N., P.O. Box 2446, Ft. Lauderdale, FL 33303 305-761-8855
 Fleming Firearms, 7720 E 126th St. N, Collinsville, OK 74021-7016 918-665-3624
 Flents Products Co., Inc., P.O. Box 2109, Norwalk, CT 06852 203-866-2581; FAX: 203-854-9322
 Flintlocks, Etc. (See Beauchamp & Son, Inc.)
 Flitz International Ltd., 821 Mohr Ave., Waterford, WI 53185 414-534-5898; FAX: 414-534-2991
 Flores Publications, Inc., J. (See Action Direct, Inc.)
 Flow-Rite of Tennessee, Inc., 107 Allen St., P.O. Box 196, Bruceton, TN 38317 901-586-2271; FAX: 901-586-2300
 Fluoramics, Inc., 18 Industrial Ave., Mahwah, NJ 07430 800-922-0075, 201-825-7035
 Flynn's Custom Guns, P.O. Box 7461, Alexandria, LA 71306 318-455-7130
 FN Herstal, Voie de Liege 33, Herstal 4040, BELGIUM (32)41.40.82.83; FAX: (32)41.40.86.79
 Fobus International Ltd., P.O. Box 64, Kfar Hess, ISRAEL 40692 972-9-7964170; FAX: 972-9-7964169
 Folks, Donald E., 205 W. Lincoln St., Pontiac, IL 61764 815-844-7901
 Foothills Video Productions, Inc., P.O. Box 651, Spartanburg, SC 29304 803-573-7023, 800-782-5358
 Foredom Electric Co., Rt. 6, 16 Stony Hill Rd., Bethel, CT 06801 203-792-8622
 Forgett Jr., Valmore J., 689 Bergen Blvd., Ridgefield, NJ 07657 201-945-2500; FAX: 201-945-6859; E-MAIL: ValForgett@msn.com
 Forgrees Tool Mfg., Inc., P.O. Box 990, 723 Austin St., Robert Lee, TX 76945 915-453-2800; FAX: 915-453-2460
 Forkin, Ben (See Belt MTN Arms)
 Forrest, Inc., Tom, P.O. Box 326, Lakeside, CA 92040 619-561-5800; FAX: 619-561-0227
 Forrest Tool Co., P.O. Box 768, 44380 Gordon Lane, Mendocino, CA 95460 707-937-2141; FAX: 717-937-1817
 Forster, Kathy (See Custom Checkering Service)
 Forster, Larry L., P.O. Box 212, 220 First St. NE, Gwinner, ND 58040-0212 701-678-2475
 Forster Products, 82 E. Lanark Ave., Lanark, IL 61046 815-493-6360; FAX: 815-493-2371
 Fort Hill Gunstocks, 12807 Fort Hill Rd., Hillsboro, OH 45133 513-466-2763
 Fort Knox Security Products, 1051 N. Industrial Park Rd., Orem, UT 84057 801-224-7233, 800-821-5216; FAX: 801-226-5493
 Fort Worth Firearms, 2006-B Martin Luther King Fwy., Ft. Worth, TX 76104-6303 817-536-0718; FAX: 817-535-0290
 Forthofer's Gunsmithing & Knifemaking, 5535 U.S. Hwy 93S, Whitefish, MT 59937-8411 406-862-2674
 Fortune Products, Inc., HC04, Box 303, Marble Falls, TX 78654 210-693-6111; FAX: 210-693-6394
 Forty Five Ranch Enterprises, Box 1080, Miami, OK 74355-1080 918-542-5875
 Fotar Optics, 1756 E. Colorado Blvd., Pasadena, CA 91106 818-579-3919; FAX: 818-579-7209
 Fouling Shot, The, 6465 Parfet St., Arvada, CO 80004
 Fountain Products, 492 Prospect Ave., West Springfield, MA 01089 413-781-4651; FAX: 413-733-8217

4-D Custom Die Co., 711 N. Sandusky St., P.O. Box 889, Mt. Vernon, OH 43050-0889 614-397-7214; FAX: 614-397-6600
 Fowler, Bob (see Black Powder Products)
 4W Ammunition (See Hunters Supply)
 Fowler Bullets, 806 Dogwood Dr., Gastonia, NC 28054 704-867-3259
 Fox River Mills, Inc., P.O. Box 298, 227 Poplar St., Osage, IA 50461 515-732-3798; FAX: 515-732-5128
 Foy Custom Bullets, 104 Wells Ave., Daleville, AL 36322
 Francesca, Inc., 3115 Old Ranch Rd., San Antonio, TX 78217 512-826-2584; FAX: 512-826-8211
 Franchi S.p.A., Via del Serpente, 12, 25131 Brescia, ITALY 030-3581833; FAX: 030-3581554 (U.S. importer—American Arms, Inc.)
 Francotte & Cie S.A., Auguste, rue du Trois Juin 109, 4400 Herstal-Liege, BELGIUM 32-4-248-13-18; FAX: 32-4-948-11-79
 Frank Custom Classic Arms, Ron, 7131 Richland Rd., Ft. Worth, TX 76118 817-284-9300; FAX: 817-284- 9300
 Frank Knives, 13868 NW Keleka Pl., Seal Rock, OR 97376 541-563-3041; FAX: 541-563-3041
 Frankonia Jagd, Hofmann & Co., D-97064 Würzburg, GERMANY 09302-200; FAX: 09302-20200
 Franzen International, Inc. (U.S. importer for Peters Stahl GmbH)
 Frazier Brothers Enterprises, 1118 N. Main St., Franklin, IN 46131 317-736-4000; FAX: 317-736- 4000
 Freedom Arms, Inc., P.O. Box 1776, Freedom, WY 83120 307-883-2468, 800-833-4432 (orders only); FAX: 307-883-2005
 Freeman Animal Targets, 5519 East County Road, 100 South, Plainsfield, IN 46168 317-272-2663; FAX: 317-272-2674; E-MAIL: Signs @ indy .net; WEB: http: www.freemansighs.com
 Fremont Tool Works, 1214 Prairie, Ford, KS 67842 316-369-2327
 French, J.R., Artistic Engraving, 1712 Creek Ridge Ct., Irving, TX 75060 214-254-2654
 Frielich Police Equipment, 211 East 21 st St., New York, NY 10010 212-254-3045
 Europtik Ltd., P.O. Box 319,, Dunmore, PA 18512 717- 347-6049; FAX: 717-969-4330
 Front Sight Firearms Training Institute, P.O. Box 2619, Aptos, C A 95001 800-987-7719; FAX: 408-684-2137
 Frontier, 2910 San Bernardo, Laredo, TX 78040 210- 723-5409; FAX: 210-723-1774
 Frontier Arms Co., Inc., 401 W. Rio Santa Cruz, Green Valley, AZ 85614-3932
 Frontier Products Co., 164 E. Longview Ave., Columbus, OH 43202 614-262-9357
 Frontier Safe Co., 3201 S. Clinton St., Fort Wayne, IN 46806 219-744-7233; FAX: 219-744-6678
 Frost Cutlery Co., P.O. Box 22636, Chattanooga, TN 37422 615-894-6079; FAX: 615-894-9576
 Fry Metals, 4100 6th Ave., Altoona, PA 16602 814- 946-1611
 FTI, Inc., 72 Eagle Rock Ave., Box 366, East Hanover, NJ 07936-3104
 Fujinon, Inc., 10 High Point Dr., Wayne, NJ 07470 201-633-5600; FAX: 201-633-5216
 Fullmer, Geo. M., 2499 Mavis St., Oakland, CA 94601 510-533-4193
 Fulmer's Antique Firearms, Chet, P.O. Box 792, Rt. 2 Buffalo Lake, Detroit Lakes, MN 56501 218-847- 7712
 Fulton Armory, 8725 Bollman Place No. 1, Savage, MD 20763 301-490-9485; FAX: 301-490-9547
 Furr Arms, 91 N. 970 W., Orem, UT 84057 801-226- 3877; FAX: 801-226-3877
 Fusilier Bullets, 10010 N. 6000 W., Highland, UT 84003 801-756-6813
 FWB, Neckarstrasse 43, 78727 Obemdorf a. N., GERMANY 07423-814-0; FAX: 07423-814-89 (U.S. importer—Beeman Precision Airguns)

G

G96 Products Co., Inc., River St. Station, P.O. Box 1684, Paterson, NJ 07544 201-684-4050; FAX: 201- 684-3848
 G&C Bullet Co., Inc., 8835 Thornton Rd., Stockton, CA 95209 209-477-6479; FAX: 209-477-2813
 G&H Decoys, Inc., P.O. Box 1208, Hwy. 75 North, Henryetta, OK 74437 918-652-3314; FAX: 918-652- 3400
 Gage Manufacturing, 663 W. 7th St., A, San Pedro, CA 90731 310-832-3546
 Gaillard Barrels, P.O. Box 21, Pathlow, Sask., S0K 3B0 CANADA 306-752-3769; FAX: 306-752-5969
 Gain Twist Barrel Co., Rifle Works and Armory, 707 12th Street, Cody, WY 82414 307-587-4914; FAX: 307-527-6097
 Galati International, P.O. Box 326, Catawissa, MO 63015 314-257-4837; FAX: 314-257-2268
 Galaxy Imports Ltd., Inc., P.O. Box 3361, Victoria, TX 77903 512-573-4867; FAX: 512-576-9622
 GALCO International Ltd., 2019 W. Quail Ave., Phoenix, AZ 85027 602-258-8295, 800-874-2526; FAX: 602-582-6854
 Gamba S.p.A.-Societa Armi Bresciane Sri., Renato, Via Artigiani, 93, 25063 Gardone Val Trompia (BS), ITALY 30-8911640; FAX: 30-8911648 (U.S. importer—Gamba, USA)
 Gamba, USA, P.O. Box 60452, Colorado Springs, CO 80960 719-578-1145; FAX: 719-444-0731
 Gamco, 1316 67th Street, Emeryville, CA 94608 510- 527-5578
 Game Haven Gunstocks, 13750 Shire Rd., Wolverine, MI 49799 616-525-8257

Game Winner, Inc., 2625 Cumberland Parkway, Suite 220, Atlanta, GA 30339 770-434-9210; FAX: 770- 434-9215
 Gamo (See U.S. importers—Arms United Corp.; Daisy Mfg. Co.; Dynamit Nobel-RWS, Inc.; Gamo USA, Inc.)
 Gamo USA, Inc., 3911 SW 47th Ave., Suite 914, Ft. Lauderdale, FL 33314 343-640-7248; FAX: 343-654- 0900
 Gander Mountain, Inc., P.O. Box 128, Hwy. W., Wilmet, WI 53192 414-862-2331, Ext. 6425
 GAR, 590 McBride Avenue, West Paterson, NJ 07424 201-754-1114; FAX: 201-754-1114
 Garbi, Armas Urki, 12-14, 20.600 Eibar (Guipuzcoa) SPAIN 43-11 38 73 (U.S. importer—Moore & Co., Wm. Larkin)
 Garcia National Gun Traders, Inc., 225 SW 22nd Ave., Miami, FL 33135 305-642-2355
 Garrett Cartridges, Inc., P.O. Box 178, Chehalis, WA 98532 360-736-0702
 Garthwaite, Pistolsmith, Inc., Jim, Rt. 2, Box 310, Watsontown, PA 17777 717-538-1566; FAX: 717-538-2965
 Gator Guns & Repair, 6255 Spur Hwy., Kenai, AK 99611 907-283-7947
 Gaucher Armes, S.A., 46, rue Desjoyaux, 42000 Saint- Etienne, FRANCE 04-77-33-38-92; FAX: 04-77-61- 95-72
 G.C.C.T., 4455 Torrance Blvd., Ste. 453, Torrance, CA 90509-2806
 GDL Enterprises, 409 Le Gardeur, Slidell, LA 70460 504-649-0693
 Gehmann, Walter (See Huntington Die Specialties)
 Genco, P.O. Box 5704, Asheville, NC 28803
 Genecco Gun Works, K., 10512 Lower Sacramento Rd., Stockton, CA 95210 209-951 -0706
 General Lead, Inc., 1022 Grand Ave., Phoenix, AZ 85007
 Gene's Custom Guns, P.O. Box 10534, White Bear Lake, MN 55110 612-429-5105
 Gentex Corp., 5 Tinkham Ave., Derry, NH 03038 603- 434-0311; FAX: 603-434-3002
 Gentner Bullets, 109 Woodlawn Ave., Upper Darby, PA 19082 610-352-9396
 Gentry Custom Gunmaker, David, 314 N. Hoffman, Belgrade, MT 59714 406-388-GUNS
 George & Roy's, 2950 NW 29th, Portland, OR 97210 503-228-5424, 800-553-3022; FAX: 503-225-9409
 George, Tim, Rt. 1, P.O. Box 45, Evinston, VA 24550 804-821-8117
 Gerber Legendary Blades, 14200 SW 72nd Ave., Portland, OR 97223 503-639-6161, 800-950-6161; FAX: 503-684-7008
 Gervais, Mike, 3804 S. Cruise Dr., Salt Lake City, UT 84109 801-277-7729
 Getz Barrel Co., P.O. Box 88, Beavertown, PA 17813 717-658-7263
 G.G. & G., 3602 E. 42nd Stravenue, Tucson, AZ 85713 520-748-7167; FAX: 520-748-7583
 G.H. Enterprises Ltd., Bag 10, Okotoks, Alberta T0L 1 TO CANADA 403-938-6070
 Giacomo Sporting USA, 6234 Stokes Lee Center Rd., Lee Center, NY 13363
 Gibbs Rifle Co., Inc., Cannon Hill Industrial Park, Rt. 2, Box 214 Hoffman, Rd. Martinsburg, WV 25401 274-0458; FAX: 304-274-0078
 Gilbert Equipment Co., Inc., 960 Downtowner Rd., Mobile, AL 36609 205-344-3322
 Gilkes, Anthony W., 5950 Sheridan Blvd., Arvada, CO 80003 303-657-1873; FAX: 303-657-1885
 Gillmann, Edwin, 33 Valley View Dr., Hanover, PA 17331 717-632-1662
 Gilman-Mayfield, Inc., 3279 E. Shields, Fresno, CA 93703 209-221-9415; FAX: 209-221-9419
 Gilmore Sports Concepts, 5949 S. Garnett, Tulsa, OK 74146 918-250-4867; FAX: 918-250-3845
 Giron, Robert E., 1328 Pocono St., Pittsburgh, PA 15218 412-731-6041
 Glacier Glove, 4890 Aircenter Circle, Suite 210, Reno, NV 89502 702-825-8225; FAX: 702-825-6544
 Glaser Safety Slug, Inc., P.O. Box 8223, Foster City, CA 94404 800-221-3489, 510-785-7754; FAX: 510- 785-6685
 Glass, Herb, P.O. Box 25, Bullville, NY 10915 914- 361-3021
 Glimm, Jerome C., 19 S. Maryland, Conrad, MT 59425 406-278-3574
 Glock GmbH, P.O. Box 50, A-2232 Deutsch Wagram, AUSTRIA (U.S. importer—Glock, Inc.)
 Glock, Inc., P.O. Box 369, Smyrna, GA 30081 770- 432-1202; FAX: 770-433-8719
 GML Products, Inc., 394 Laredo Dr., Birmingham, AL 35226 205-979-4867
 Gner's Hard Cast Bullets, 1107 11th St., LaGrande, OR 97850 503-963-8796
 Goddard, Allen, 716 Medford Ave., Hayward, CA 94541 510-276-6830
 Goens, Dale W., P.O. Box 224, Cedar Crest, NM 87008 505-281-5419
 Goergen's Gun Shop, Inc., Rt. 2, Box 182BB, Austin, MN 55912 507-433-9280
 GOEX, Inc., 1002 Springbrook Ave., Moosic, PA 18507 717-457-6724; FAX: 717-457-1130
 Goldcoast Reloaders, Inc., 4260 NE 12th Terrace, Pompano Beach, FL 33064 954-783-4849; FAX: 954- 942-3452
 Golden Age Arms Co., 115 E. High St., Ashley, OH 43003 614-747-2488
 Golden Bear Bullets, 3065 Fairfax Ave., San Jose, CA 95148 408-238-9515

Gonic Arms, Inc., 134 Flagg Rd., Gonic, NH 03839 332-8456, 603-332-8457
 Gonic Bullet Works, P.O. Box 7365, Gonic, NH 03839
 Gonzalez Guns, Ramon B., P.O. Box 370, 93 St. Joseph's Hill Road, Monticello, NY 12701 914-794- 4515
 Goodling's Gunsmithing, R.D. 1, Box 1097, Spring Grove, PA 17362 717-225-3350
 Goodwin, Fred, Silver Ridge Gun Shop, Sherman Mills, ME 04776 207-365-4451
 Gordie's Gun Shop, 1401 Fulton St., Streator, IL 61364 815-672-7202
 Gotz Bullets, 7313 Rogers St., Rockford, IL 61111
 Goudy Classic Stocks, Gary, 263 Hedge Rd., Menlo Park, CA 94025-1711 415-322-1338
 Gould & Goodrich, P.O. Box 1479, Lillington, NC 27546 910-893-2071; FAX: 910-893-4742
 Goumet, Geoffroy, 820 Paxinosa Ave., Easton, PA 18042 610-559-0710
 Gozon Corp., U.S.A., P.O. Box 6278, Folsom, CA 95763 916-983-2026; FAX: 916-983-9500
 Grace, Charles E., 1305 Arizona Ave., Trinidad, CO 81082 719-846-9435
 Grace Metal Products, Inc., P.O. Box 67, Elk Rapids, MI 49629 616-264-8133
 Graf & Sons, Route 3 Highway 54 So., Mexico, MO 65265 573-581-2266; FAX: 573-581-2875
 "Gramps" Antique Cartridges, Box 341, Washago, Ont. L0K 2B0 CANADA 705-689-5348
 Grand Falls Bullets, Inc., P.O. Box 720, 803 Arnold Wallen Way, Stockton, MO 65785 816-229-0112
 Granite Custom Bullets, Box 190, Philipsburg, MT 406-859-3245
 Grant, Howard V., Hiawatha 15, Woodruff, WI 54568 715-356-7146
 Graphics Direct, P.O. Box 372421, Reseda, CA 91337- 2421 818-344-9002
 Graves Co., 1800 Andrews Ave., Pompano Beach, FL 33069 800-327-9103; FAX: 305-960-0301
 Grayback Wildcats, 5306 Bryant Ave., Klamath Falls, OR 97603 541-884-1072
 Graybill's Gun Shop, 1035 Ironville Pike, Columbia, PA 17512 717-684-2739
 Great American Gunstock Co., 3420 Industrial Drive, Yuba City, CA 95993 916-671 -4570; FAX: 916-671 - 3906
 Great Lakes Airguns, 6175 S. Park Ave., Hamburg, NY 14075 716-648-6666; FAX: 716-648-5279
 Green, Arthur S., 485 S. Robertson Blvd., Beverly Hills, CA 90211 310-274-1283
 Green Genie, Box 114, Cusseta, GA 31805
 Green Head Game Call Co., RR 1, Box 33, Lacon, IL 61540 309-246-2155
 Green Mountain Rifle Barrel Co., Inc., P.O. Box 2670, 153 West Main St., Conway, NH 03818 603-447- 1095; FAX: 603-447-1099
 Green, Roger M., P.O. Box 984,435 E. Birch, Glenrock, WY 82637 307-436-9804
 Greene Precision Duplicators, M.L. Greene Engineering Services, P.O. Box, 1150, Golden, CO 80402-1150 303-279-2383
 Greenwald, Leon E. "Bud", 2553 S. Quitman St., Denver, CO 80219 303-935-3850
 Greenwood Precision, P.O. Box 468, Nixa, MO 65714- 0468 417-725-2330
 Greg Gunsmithing Repair, 3732 26th Ave. North, Robbinsdale, MN 55422 612-529-8103
 Greg's Superior Products, P.O. Box 46219, Seattle, WA 98146
 Greider Precision, 431 Santa Marina Ct., Escondido, CA 92029 619-480-8892; FAX: 619-480-9800; E- MAIL: Greider@msn.com
 Gremmel Enterprises, 2111 Carriage Drive, Eugene, OR 97408-7537 541-302-3000
 Grfc-Tan Rifles, 29742 W.C.R. 50, Kersey, CO 80644 970-353-6176; FAX: 970-356-9133
 Grier's Hard Cast Bullets, 1107 11th St., LaGrande, OR 97850 503-963-8796
 Griffin & Howe, Inc., 33 Claremont Rd., Bernardsville, NJ 07924 908-766-2287; FAX: 908-766-1068
 Griffin & Howe, Inc., 36 W. 44th St., Suite 1011, New York, NY 10036 212-921-0980
 Grifon, Inc., 58 Guinam St., Waltham, MS 02154
 Groenewold, John, P.O. Box 830, Mundelein, IL 60060 847-566-2365
 Group Tight Bullets, 482 Comerwood Court, San Francisco, CA 94080 415-583-1550
 GRS Corp., Glendo, P.O. Box 1153,900 Overlander St., Emporia, KS 66801 316-343-1084, 800-835-3519
 Grulla Armes, Apartado 453, Avda Otaola, 12, Eiber, SPAIN (U.S. importer—American Arms, Inc.)
 GSI, Inc., 108 Morrow Ave., P.O. Box 129, Trussville, AL 35173 205-655-8299; FAX: 205-655-7078
 G.U., Inc. (U.S. importer for New SKB Arms Co.; SKB Arms Co.)
 Guardsman Products, 411 N. Darling, Fremont, MI 49412 616-924-3950
 Gun Accessories (See Glaser Safety Slug, Inc.)
 Gun-Alert, 1010 N. Maclay Ave., San Fernando, CA 91340 818-365-0864; FAX: 818-365-1308
 Gun City, 212 W. Main Ave., Bismarck, ND 58501 701-223-2304
 Gun Doctor, The, 435 East Maple, Roselle, IL 60172 708-894-0668
 Gun Doctor, The, P.O. Box 39242, Downey, CA 90242 310-862-3158
 Gun-Ho Sports Cases, 110 E. 10th St., St. Paul, MN 55101 612-224-9491
 Gun Hunter Books (See Gun Hunter Trading Co.)
 Gun Hunter Trading Co., 5075 Heisig St., Beaumont, TX 77705 409-835-3006

Gun Leather Limited, 116 Lipscomb, Ft. Worth, TX 76104 817-334-0225; 800-247-0609
 Gun List (See Krause Publications, Inc.)
 Gun Locker, Div. of Airmold, W.R. Grace & Co.- Conn., Becker Farms Ind. Park., P.O. Box 610 Roanoke Rapids, NC 27870
 800-344-5716; FAX: 919-536-2201
 Gun Parts Corp., The, 226 Williams Lane, West Hurley, NY 12491 914-679-2417; FAX: 914-679-5849
 Gun Room, The, 1121 Burlington, Muncie, IN 47302 282-9073; FAX: 317-282-5270
 Gun Room Press, The, 127 Raritan Ave., Highland Park, NJ 08904 908-545-4344; FAX: 908-545-6686
 Gun Shop, The, 5550 S. 900 East, Salt Lake City, UT 84117 801-263-3633
 Gun Shop, The, 62778 Spring Creek Rd., Montrose, CO 81401
 Gun Shop, The, 716-A South Rogers Road, Olathe, KS 66062
 Gun South, Inc. (See GSI, Inc.)
 Gun-Tec, P.O. Box 8125, W. Palm Beach, FL 33407
 Gun Works, The, 247 S. 2nd, Springfield, OR 97477 541 -741 -4118; FAX: 541 -988-1097
 Guncraft Books (See Guncraft Sports, Inc.)
 Guncraft Sports, Inc., 10737 Dutchtown Rd., Knoxville, TN 37932 423-966-4545; FAX: 423-966-4500
 Gunfitters, The, P.O. 426, Cambridge, WI53523-0426 608-764-8128
 Gunline Tools, 2950 Saturn St., "O", Brea, CA 92821 714-993-5100; FAX: 714-572-4128
 Gunnerman Books, P.O. Box 217, Owosso, MI 48867 517-729-7018; FAX: 517-725-9391
 Guns, 81 E. Streetsboro St., Hudson, OH 44236 216- 650-4563
 Guns Antique & Modern DBA Charles E. Duffy, Williams Lane, West Hurley, NY 12491 914-679- 2997
 Guns, Div. of D.C. Engineering, Inc., 8633 Southfield Fwy., Detroit, MI 48228 313-271-7111, 800-886- 7623 (orders only); FAX: 313-271-7112
 GUNS Magazine, 591 Camino de la Reina, Suite 200, San Diego, CA 92108 619-297-5350; FAX: 619-297- 5353
 Gunsight, The, 1712 North Placentia Ave., Fullerton, CA 92631
 Gunsite Custom Shop, P.O. Box 451, Paulden, AZ 86334 520-636-4104; FAX: 520-636-1236
 Gunsite Gunsmithy (See Gunsite Custom Shop)
 Gunsite Training Center, P.O. Box 700, Paulden, AZ 86334 520-636-4565; FAX: 520-636-1236
 Gunsmith in Elk River, The, 14021 Victoria Lane, Elk River, MN 55330 612-441-7761
 Gunsmithing, Inc., 208 West Buchanan St., Colorado Springs, CO 80907 719-632-3795; FAX: 719-632- 3493
 Gunsmithing Ltd., 57 Unquowa Rd., Fairfield, CT 06430 203-254-0436; FAX: 203-254-1535
 Gurney, F.R., Box 13, Sooke, BC V0S 1N0 CANADA 642-5282; FAX: 604-642-7859
 Gusdorf Corp., 11440 Lackland Rd., St. Louis, MO 63146 314-567-5249
 Gusty Winds Corp., 2950 Bear St., Suite 120, Costa Mesa, CA 92626 714-536-3587
 Gwinnell, Bryson J., P.O. Box 248C, Maple Hill Rd., Rochester, VT 05767 802-767-3664

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 H&S Liner Service, 515 E. 8th, Odessa, TX 79761 915- 332-1021
 Hafner Creations, Inc., P.O. Box 1987, Lake City, FL 32055 904-755-6481; FAX: 904-755-6595
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 Half Moon Rifle Shop, 490 Halfmoon Rd., Columbia Falls, MT 59912 406-892-4409
 Hall Manufacturing, 142 CR 406, Clanton, AL 35045 205-755-4094
 Hall Plastics, Inc., John, P.O. Box 1526, Alvin, TX 77512 713-489-8709
 Hallberg Gunsmith, Fritz, P.O. Box 339, 160 N. Oregon St., Ontario, OR 97914 541-889-3135; FAX: 541- 889-2633
 Hallowell & Co., 340 W. Putnam Ave., Greenwich, CT 06830 203-869-2190; FAX: 203-869-0692
 Hally Caller, 443 Wells Rd., Doylestown, PA 18901 215-345-6354
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 Hamilton, Alex B. (See Ten-Ring Precision, Inc.)
 Hamilton, Jim, Rte. 5, Box 278, Guthrie, OK 73044 405-282-3634
 Hamilton, Keith, P.O. Box 871, Gridley, CA 95948 916-846-2316
 Hammans, Charles E., P.O. Box 788, 2022 McCracken, Stuttgart, AR 72106 501-673-1388
 Hammerli USA, 19296 Oak Grove Circle, Groveland, CA 95321 209-962-5311; FAX: 209-962-5931

Hammerli Ltd., Seonerstrasse 37, CH-5600 Lenzburg, SWITZERLAND 064-50 11 44; FAX: 064-51 38 27 (U.S. importer—Hammerli USA; Mandall Shooting Supplies, Inc.; Sigarms, Inc.)
 Hammets VLD Bullets, P.O. Box 479, Rayville, LA 71269 318-728-2019
 Hammond Custom Guns Ltd., 619 S. Pandora, Gilbert, AZ 85234 602-892-3437
 Hammonds Rifles, RD 4, Box 504, Red Lion, PA 17356 717-244-7879
 Handgun Press, P.O. Box 406, Glenview, IL 60025 657-6500; FAX: 847-724-8831
 Handicrafts Unltd. (See Clements' Custom Leathercraft, Chas)
 Hands Engraving, Barry Lee, 26192 E. Shore Route, Bigfork, MT 59911 406-837-0035
 Hank's Gun Shop, Box 370, 50 West 100 South, Monroe, UT 84754 801-527-4456
 Hanned Line, The, P.O. Box 2387, Cupertino, CA 95015-2387
 Hanned Precision (See Hanned Line, The)
 Hansen & Co. (See Hansen Cartridge Co.)
 Hansen Cartridge Co., 244-246 Old Post Rd., Southport, CT 06490 203-259-6222, 203-259-7337; FAX: 203- 254-3832
 Hanson's Gun Center, Dick, 233 Everett Dr., Colorado Springs, CO 80911
 Hanus Birdguns, Bill, P.O. Box 533, Newport, OR 97365 541-265-7433; FAX: 541-265-7400
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 Harold's Custom Gun Shop, Inc., Broughton Rifle Barrels, Rt. 1, Box 447, Big Spring, TX 79720 915- 394-4430
 Harper's Custom Stocks, 928 Lombrano St., San Antonio, TX 78207 210-732-5780
 Harrell's Precision, 5756 Hickory Dr., Salem, VA 24133 703-380-2683
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 Harris Enterprises, P.O. Box 105, Bly, OR 97622 503- 353-2625
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 Harris Gunworks, 3840 N. 28th Ave., Phoenix, AZ 85017-4733 602-230-1414; FAX: 602-230-1422
 Harris Publications, 1115 Broadway, New York, NY 10010 212-807-7100; FAX: 212-627-4678
 Harrison Bullets, 6437 E. Hobart St., Mesa, AZ 85205
 Harrison-Hurtz Enterprises, Inc., P.O. Box 268, RR1, Wymore, NE 68466 402-645-3378; FAX: 402-645- 3606
 Hart & Son, Inc., Robert W., 401 Montgomery St., Nescopeck, PA 18635 717-752-3655, 800-368-3656; FAX: 717-752-1088
 Hart Rifle Barrels, Inc., P.O. Box 182, 1690 Apulia Rd., Lafayette, NY 13084 315-677-9841; FAX: 315-677- 9610
 Hartford (See U.S. importer— EMF Co., Inc.)
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 Harvey, Frank, 218 Nightfall, Terrace, NV 89015 702- 558-6998
 Harwood, Jack O., 1191 S. Pendlebury Lane, Blackfoot, ID 83221 208-785-5368
 Haselbauer Products, Jerry, P.O. Box 27629, Tucson, AZ 85726 602-792-1075
 Hastings Barrels, 320 Court St., Clay Center, KS 67432 913-632-3169; FAX: 913-632-6554
 Hawk, Inc., 849 Hawks Bridge Rd., Salem, NJ 08079 299-2700; FAX: 609-299-2800
 Hawk Laboratories, Inc. (See Hawk, Inc.)
 Hawken Shop, The (See Dayton Traister)
 Haydel's Game Calls, Inc., 5018 Hazel Jones Rd., Bossier City, LA 71111 318-746-3586, 800- HAYDELS; FAX: 318-746-3711
 Haydon Shooters' Supply, Russ, 15018 Goodrich Dr. NW, Gig Harbor, WA 98329 253-857-7557; FAX: 253-857-7884
 Heatbath Corp., P.O. Box 2978, Springfield, MA 01101 413-543-3381
 Hebard Guns, Gil, 125-129 Public Square, Knoxville, IL 61448
 HEBB Resources, P.O. Box 999, Mead, WA 99021- 09996 509-466-1292
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 Heckler & Koch GmbH, P.O. Box 1329, 78722 Obemdorf, Neckar, GERMANY 49-7423179-0; FAX: 49-7423179-2406 (U.S. importer—Heckler & Koch, Inc.)
 Heckler & Koch, Inc., 21480 Pacific Blvd., Sterling, VA 20166-8903 703-450-1900; FAX: 703-450-8160
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 Heidenstrom Bullets, Urds GT 1 Heroya, 3900 Porsgrunn, NORWAY
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 Heinie Specialty Products, 301 Oak St., Quincy, IL 62301-2500 309-543-4535; FAX: 309-543-2521
 Heintz, David, 800 N. Hwy. 17, Moffat, CO 81143 719-256-4194

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 Hendricks Gun Works, 1162 Gillionville Rd., Albany, GA 31707 912-439-2003
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 Henriksen Tool Co., Inc., 8515 Wagner Creek Rd., Talent, OR 97540 541-535-2309
 Henry Repeating Arms Co., 110 8th St., Brooklyn, NY 11215 718-499-5600
 Hensler, Jerry, 6614 Country Field, San Antonio, TX 78240 210-690-7491
 Hensley & Gibbs, Box 10, Murphy, OR 97533 541- 862-2341
 Hensley, Gunmaker, Darwin, P.O. Box 329, Brightwood, OR 97011 503-622-5411
 Heppler, Keith M., Keith's Custom Gunstocks, 540 Banyan Circle, Walnut Creek, CA 94598 510-934- 3509; FAX: 510-934-3143
 Heppler's Machining, 2240 Calle Del Mundo, Santa Clara, CA 95054 408-748-9166; FAX: 408-988-7711
 Hercules, Inc. (See Alliant Techsystems, Smokeless Powder Group)
 Heritage Firearms (See Heritage Manufacturing, Inc.)
 Heritage Manufacturing, Inc., 4600 NW 135th St., Opa Locka, FL 33054 305-685-5966; FAX: 305-687-6721
 Heritage VSP Gun Books, P.O. Box 887, McCall, ID 83638 208-634-4104; FAX: 208-634-3101
 Heritage Wildlife Carvings, 2145 Wagner Hollow Rd., Fort Plain, NY 13339 518-993-3983
 Hermann Leather Co., H.J., Rt. 1, P.O. Box 525, Skiatook, OK 74070 918-396-1226
 Herrett's Stocks, Inc., P.O. Box 741, Twin Falls, ID 83303 208-733-1498
 Hertel & Reuss, Werk f,r Optik und Feinmechanik GmbH, Quellhofstrasse, 67 34 127 Kassel, GERMANY 0561-83006; FAX: 0561-893308
 Herter's Manufacturing, Inc., 111 E. Burnett St., P.O. Box 518, Beaver Dam, WI 53916 414-887-1765; FAX: 414-887-8444
 Hesco-Meprolight, 2139 Greenville Rd., LaGrange, GA 30241 706-884-7967; FAX: 706-882-4683
 Heydenberk, Warren R., 1059 W. Sawmill Rd., Quakertown, PA 18951 215-538-2682
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 High Performance International, 5734 W. Florist Ave., Milwaukee, WI 53218 414-466-9040
 High Standard Mfg. Co., Inc., 4601 S. Pinemont, Suite 144, Houston, TX 77041 713-462-4200; FAX: 713- 462-6437
 High Tech Specialties, Inc., P.O. Box 387R, Adamstown, PA 19501 215-484-0405, 800-231-9385
 Highline Machine Co., 654 Lela Place, Grand Junction, CO 81504 970-434-4971
 Hill, Loring F., 304 Cedar Rd., Elkins Park, PA 19117
 Hill Speed Leather, Ernie, 4507 N. 195th Ave., Litchfield Park, AZ 85340 602-853-9222; FAX: 602-853-9235
 Hillmer Custom Gunstocks, Paul D., 7251 Hudson Heights, Hudson, IA 50643 319-988-3941
 Hinman Outfitters, Bob, 1217 W. Glen, Peoria, IL 61614 309-691-8132
 Hi-Grade Imports, 8655 Monterey Rd., Gilroy, CA 95021 408-842-9301; FAX: 408-842-2374
 Hi-Point Firearms, 5990 Philadelphia Dr., Dayton, OH 45415 513-275-4991; FAX: 513-522-8330
 Hi-Performance Ammunition Company, 484 State Route 366, Apollo, PA 15613 412-327-8100
 Hiptmayer, Armurier, RR 112 750, P.O. Box 136, Eastman, Quebec JOE 1P0, CANADA 514-297-2492
 Hiptmayer, Heidemarie, RR 112 750, P.O. Box 136, Eastman, Quebec JOE IPO, CANADA 514-297-2492
 Hiptmayer, Klaus, RR 112 750, P.O. Box 136, Eastman, Quebec JOE 1P0, CANADA 514-297-2492
 Hirtenberger Aktiengesellschaft, Leobersdorferstrasse 31, A-2552 Hirtenberg, AUSTRIA 43(0)2256 81184; FAX: 43(0)2256 81807
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 H.K.S. Products, 7841 Founion Dr., Florence, KY 41042 606-342-7841, 800-354-9814; FAX: 606-342- 5865
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 Hobbie Gunsmithing, Duane A., 2412 Pattie Ave., Wichita, KS 67216 316-264-8266
 Hobson Precision Mfg. Co., Rt. 1, Box 220-C, Brent, AL 35034 205-926-4662
 Hoch Custom Bullet Moulds (See Colorado Shooter's Supply)
 Hodgdon Powder Co., 6231 Robinson, Shawnee Mission, KS 66202 913-362-9455; FAX: 913-362- 1307; WEB: <http://www.hodgdon.com>

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Hodgson, Richard, 9081 Tahoe Lane, Boulder, CO 80301
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Hoenig & Rodman, 6521 Morton Dr., Boise, ID 83704 208-375-1116
Hofer Jagdwaffen, P., Buchsenmachermeister, Kirchgasse 24, A-9170 Ferlach, AUSTRIA 04227- 3683
Hoffman New Ideas, 821 Northmoor Rd., Lake Forest, IL 60045 312-234-4075
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Holland's Gunsmithing, P.O. Box 69, Powers, OR 97466 541-439-5155; FAX: 541-439-5155
Hollis Gun Shop, 917 Rex St., Carlsbad, NM 88220 505-885-3782
Hollywood Engineering, 10642 Arminta St., Sun Valley, CA 91352 818-842-8376
Holster Shop, The, 720 N. Flagler Dr., Ft. Lauderdale, FL 33304 305-463-7910; FAX: 305-761-1483
Homak, 5151 W. 73rd St., Chicago, IL 60638-6613 523-3100, FAX: 312-523-9455
Home Shop Machinist, The, Village Press Publications, P.O. Box 1810, Traverse City, MI 49685 800-447- 7367; FAX: 616-946-3289
Hondo Ind., 510 S. 52nd St., 104, Tempe, AZ 85281
Hoover, Harvey, 5750 Pearl Dr., Paradise, CA 95969- 4829
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Hoyt Holster Co., Inc., P.O. Box 69, Coupeville, WA 98239-0069 360-678-6640; FAX: 360-678-6549
H-S Precision, Inc., 1301 Turbine Dr., Rapid City, SD 57701 605-341-3006; FAX: 605-342-8964
HT Bullets, 244 Belleville Rd., New Bedford, MA 02745 508-999-3338
Hubertus Schneidwarenfabrik, P.O. Box 180 106, D- 42626 Solingen, GERMANY 01149-212-59-19-94; FAX: 01149-212-59-19-92
Huebner, Corey O., P.O. Box 2074, Missoula, MT 59806-2074 406-721-7168
Huey Gun Cases, P.O. Box 22456, Kansas City, MO 64113 816-444-1637; FAX: 816-444-1637
Hugger Hooks Co., 3900 Easley Way, Golden, CO 80403 303-279-0600
Hughes, Steven Dodd, P.O. Box 545, Livingston, MT 59047 406-222-9377
Hume, Don, P.O. Box 351, Miami, OK 74355 918-542- 6604; FAX: 918-542-4340 *
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Hunter Co., Inc., 3300 W. 71st Ave., Westminster, CO 80030 303-427-4626; FAX: 303-428-3980
Hunters Supply, Rt. 1, P.O. Box 313, Tioga, TX 76271 800-868-6612; FAX: 817-437-2228
Hunter's Specialties, Inc., 6000 Huntington Ct. NE, Cedar Rapids, IA 52402-1268 319-395-0321; FAX: 319-395-0326
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Hunting Classics Ltd., P.O. Box 2089, Gastonia, NC 28053 704-867-1307; FAX: 704-867-0491
Huntington Die Specialties, 601 Oro Dam Blvd., Oroville, CA 95965 916-534-1210; FAX: 916-534- 1212
Hutton Rifle Ranch, P.O. Box 45236, Boise, ID 83711 208-345-8781
Hydrosorbent Products, P.O. Box 437, Ashley Falls, MA 01222 413-229-2967; FAX: 413-229-8743
Hyper-Single, Inc., 520 E. Beaver, Jenks, OK 74037 918-299-2391

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 Ibberson (Sheffield) Ltd., George, 25-31 Allen St., Sheffield, S3 7AW ENGLAND 0114-2766123; FAX: 0114-2738465
 ICI-America, P.O. Box 751, Wilmington, DE 19897 302-575-3000
 I.D.S.A. Books, 1324 Stratford Drive, Piqua, OH 45356 937-773-4203; FAX: 937-778-1922.
 IGA (See U.S. importer—Stoeger Industries)
 Illinois Lead Shop, 7742 W. 61st Place, Summit, IL 60501
 Image Ind. Inc., 864 Lively, Wood Dale, IL 60191 630-1340; FAX: 630-616-1341
 Image Ind. Inc., 382 Balm Court, Wood Dale, IL 60191 630-766-2402; FAX: 630-766-7373
 IMI, P.O. Box 1044, Ramat Hasharon 47100, ISRAEL 972-3-5485617; FAX: 972-3-5406908
 IMI Services USA, Inc., 2 Wisconsin Circle, Suite 420, Chevy Chase, MD 20815 301-215-4800; FAX: 301- 657-1446
 Impact Case Co., P.O. Box 9912, Spokane, WA 99209- 0912 800-262-3322, 509-467-3303; FAX: 509-326- 5436
 Imperial (See E-Z-Way Systems)
 Imperial Magnur%Corp., P.O. Box 249, Oroville, WA 98844 604-495-3131; FAX: 604-495-2816
 Imperial Russian Armory, 10547 S. Post Oak, Houston, TX 77035 1-800-MINIATURE
 Imperial Schrade Corp., 7 Schrade Ct., Box 7000, Ellenville, NY 12428 914-647-7601; FAX: 914-647- 8701
 Import Sports Inc., 1750 Brielle Ave., Unit B1, Wanamassa, NJ 07712 908-493-0302; FAX: 908-493-0301
 IMR Powder Co., 1080 Military Turnpike, Suite 2, Plattsburgh, NY 12901 518-563-2253; FAX: 518- 563-6916
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 Independent Machine & Gun Shop, 1416 N. Hayes, Pocatello, ID 83201
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 Innovative Weaponry, Inc., 337 Eubank NE, Albuquerque, NM 87123 800-334-3573, 505-296- 4645; FAX: 505-271-2633
 Innovision Enterprises, 728 Skinner Dr., Kalamazoo, MI 49001 616-382-1681; FAX: 616-382-1830
 INTEC International, Inc., P.O. Box 5708, Scottsdale, AZ 85261 602-483-1708
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 Intercontinental Munitions Distributors, Ltd., P.O. Box 815, Beulah, ND 58523 701-948-2260; FAX: 701-948-2282
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 Intratec, 12405 SW 130th St., Miami, FL 33186-6224 305-232-1821; FAX: 305-253-7207
 Iosso Products, 1485 Lively Blvd., Elk Grove Village, IL 60007 847-437-8400; FAX: 847-437-8478
 Iron Bench, 12619 Bailey Rd., Redding, CA 96003 916-241-4623
 Iron Mountain Knife Co., P.O. Box 2146, Sparks, NV 89432-2146 702-356-3632; FAX: 702-356-3640
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 Ironsighter Co., P.O. Box 85070, Westland, MI 48185 313-326-8731; FAX: 313-326-3378
 Irwin, Campbell H., 140 Hartland Blvd., East Hartland, CT 06027 203-653-3901
 Island Pond Gun Shop, P.O. Box 428, Cross St., Island Pond, VT 05846 802-723-4546
 Israel Arms International, Inc., 5709 Hartsdale, Houston, TX 77036 713-789-0745; FAX: 713-789- 7513
 Israel Military Industries Ltd. (See IMI)
 I.S.S., P.O. Box 185234, Ft. Worth, TX 76181 817- 595-2090
 I.S.W., 106 E. Cairo Dr., Tempe, AZ 85282
 Ithaca Gun Co., LLC, 891 Route 34-B, King Ferry, NY 13081 315-364-7171, 888-9ITHACA; FAX: 315- 364-5134
 Ivanoff, Thomas G. (See Tom's Gun Repair)

J

J-4, Inc., 1700 Via Burton, Anaheim, CA 92806 714-8315; FAX: 714-956-4421
 J&D Components, 75 East 350 North, Orem, UT 84057- 4719 801-225-7007
 J&J Products, Inc., 9240 Whitmore, El Monte, CA 91731 818-571-5228, 800-927-8361; FAX: 818-571- 8704
 J&J Sales, 1501 21st Ave. S., Great Falls, MT 59405 406-453-7549
 J&L Superior Bullets (See Huntington Die Specialties)
 J&R Engineering, P.O. Box 77, 200 Lyons Hill Rd., Athol, MA 01331 508-249-9241
 J&R Enterprises, 4550 Scotts Valley Rd., Lakeport, CA 95453
 J&S Heat Treat, 803 S. 16th St., Blue Springs, MO 64015 816-229-2149; FAX: 816-228-1135
 J.A. Blades, Inc. (See Christopher Firearms Co., Inc., E.)
 Jackalope Gun Shop, 1048 S. 5th St., Douglas, WY 82633 307-358-3441

Jaeger, Inc. Dunn's, Paul, P.O. Box 449, 1 Madison Ave., Grand Junction, TN 38039 901-764-6909; FAX: 901-764-6503
 JaegerSport, Ltd., One Wholesale Way, Cranston, RI 02920 800-962-4867, 401-944-9682; FAX: 401-946- 2587
 Jamison's Forge Works, 4527 Rd. 6.5 NE, Moses Lake, WA 98837 509-762-2659
 Jantz Supply, P.O. Box 584-GD, Davis, OK 73030- 0584 405-369-2316; FAX: 405-369-3082; WEB: [http www.jantzsupply.com](http://www.jantzsupply.com);
 E-MAIL: jantz@brightok.net
 Jarrett Rifles, Inc., 383 Brown Rd., Jackson, SC 29831 803-471-3616
 Jarvis, Inc., 1123 Cherry Orchard Lane, Hamilton, MT 59840 406-961-4392
 JAS, Inc., P.O. Box 0, Rosemount, MN 55068 612-890- 7631
 Javelina Lube Products, P.O. Box 337, San Bernardino, CA 92402 714-882-5847; FAX: 714-434-6937
 J B Adventures & Safaris, Inc., 2275 E. Arapahoe Rd.
 Ste. 109, Littleton, CO 80122-1521 303-771-0977
 JB Custom, P.O. Box 6912, Leawood, KS 66206 913- 381-2329
 Jeffredo Gunsight, P.O. Box 669, San Marcos, CA 92079 619-728-2695
 Jenco Sales, Inc., P.O. Box 1000, Manchaca, TX 78652 800-531-5301; FAX: 800-266-2373
 Jenkins Recoil Pads, Inc., 5438 E. Frontage Ln., Olney, IL 62450 618-395-3416
 Jensen Bullets, 86 North, 400 West, Blackfoot, ID 83221 208-785-5590
 Jensen's Custom Ammunition, 5146 E. Pima, Tucson, AZ 85712 602-325-3346; FAX: 602-322-5704
 Jensen's Firearms Academy, 1280 W. Prince, Tucson, AZ 85705 602-293-8516
 Jericho Tool & Die Co. Inc., RD 3 Box 70, Route 7, Bainbridge, NY 13733-9494 607-563-8222; FAX: 607-563-8560
 Jester Bullets, Rt. 1 Box 27, Orienta, OK 73737
 Jewell Triggers, Inc., 3620 Hwy. 123, San Marcos, TX 78666 512-353-2999
 J-Gar Co., 183 Turnpike Rd., Dept. 3, Petersham, MA 01366-9604
 JGS Precision Tool Mfg., 1141 S. Summer Rd., Coos Bay, OR 97420 541-267-4331; FAX: 541-267-5996
 Jim's Gun Shop (See Spradlin's) in's Precision, Jim Ketchum, 1725 Moclips Dr., Petaluma, CA 94952 707-762-3014
 J.I.T., Ltd., P.O. Box 230, Freedom, WY 83120 708-494-0937
 JLK Bullets, 414 Turner Rd., Dover, AR 72837 501- 331-4194
 Johanssons Vapentillbehör, Bert, S-430 20 Veddige, SWEDEN
 John's Custom Leather, 523 S. Liberty St., Blairsville, PA 15717 412-459-6802
 Johns Master Engraver, Bill, 7927 Ranch Roach 965, Fredericksburg, TX 78624-9545 210-997-6795
 Johnson's Gunsmithing, Inc., Neal, 208 W. Buchanan St., Suite B, Colorado Springs, CO 80907 800-284- 8671 (orders),
 719-632-3795; FAX: 719-632-3493
 Johnson Wood Products, 34968 Crystal Road, Strawberry Point, IA 52076 319-933-4930
 Johnston Bros. (See C&T Corp. TA Johnson Brothers)
 Johnston, James (See North Fork Custom Gunsmithing)
 Jonad Corp., 2091 Lakeland Ave., Lakewood, OH 44107 216-226-3161
 Jonas Appraisals & Taxidermy, Jack, 1675 S. Birch, Suite 506, Denver, CO 80222 303-757-7347; FAX: 303-639-9655
 Jones Co., Dale, 680 Hoffman Draw, Kila, MT 59920 406-755-4684
 Jones Custom Products, Neil A., 17217 Brookhouser Road, Saegertown, PA 16433 814-763-2769; FAX: 814-763-4228
 Jones Moulds, Paul, 4901 Telegraph Rd., Los Angeles, CA 90022 213-262-1510
 Jones, J.D. (See SSK Industries)
 J.P. Enterprises, Inc., P.O. Box 26324, Shoreview, MN 55126 612-486-9064; FAX: 612-482-0970
 J.P. Gunstocks, Inc., 4508 San Miguel Ave., North Las Vegas, NV 89030 702-645-0718
 JP Sales, Box 307, Anderson, TX 77830
 J.R. Distributing, 2976 E. Los Angeles Ave., Simi Valley, CA 93065 805-527-1090; FAX: 805-529- 2368
 JRP Custom Bullets, RR2 2233 Carlton Rd., Whitehall, NY 12887 518-282-0084 (a.m.), 802-438-5548 (p.m.)
 JRW, 2425 Taffy Ct., Nampa, ID 83687
 JS Worldwide DBA (See Coonan Arms)
 JSL Ltd. (See U.S. importer—Specialty Shooters Supply, Inc.)
 Juenke, Vem, 25 Bitterbush Rd., Reno, NV 89523 702-345-0225
 Jumbo Sports Products (See Bucheimer, J.M.)
 Jungkind, Reeves C., 5001 Buckskin Pass, Austin, TX 78745-2841 512-442-1094
 Jurras, L.E., P.O. Box 680, Washington, IN 47501 812-254-7698
 JWH: Software, 6947 Haggerty Rd., Hillsboro, OH 45133 513-393-2402

K

K&M Industries, Inc., Box 66, 510 S. Main, Troy, ID 83871 208-835-2281; FAX: 208-835-5211
 K&M Services, 5430 Salmon Run Rd., Dover, PA 17315 717-292-3175
 K&P Gun Co., 1024 Central Ave., New Rockford, ND 58356 701-947-2248
 K&S Mfg., 2611 Hwy. 40 East, Inglis, FL 34449 904- 447-3571

K&T Co., Div. of T&S Industries, Inc., 1027 Skyview Dr., W. Carrollton, OH 45449 513-859-8414
 KA-BAR Knives, 1116 E. State St., Olean, NY 14760 282-0130; FAX: 716-373-6245
 Ka Pu Kapili, P.O. Box 745, Honokaa, HI 96727 808- 776-1644; FAX: 808-776-1731
 Kahles, A Swarovski Company, 1 Wholesale Way, Cranston, RI 02920-5540 800-426-3089; FAX: 401- 946-2587
 Kahr Arms, P.O. Box 220,630 Route 303, Blauvelt, NY 10913 914-353-5996; FAX: 914-353-7833
 Kalispel Case Line, P.O. Box 267, Cusick, WA 99119 509-445-1121
 Kamik Outdoor Footwear, 554 Montee de Liesse, Montreal, Quebec, H4T 1P1 CANADA 514-341- 3950; FAX: 514-341-1861
 Kamyk Engraving Co., Steve, 9 Grandview Dr., Westfield, MA 01085-1810 413-568-0457
 Kandel, P.O. Box 4529, Portland, OR 97208
 Kane, Edward, P.O. Box 385, Ukiah, CA 95482 707- 462-2937
 Kane Products, Inc., 5572 Brecksville Rd., Cleveland, OH 44131 216-524-9962
 Kapro Mfg. Co., Inc. (See R.E.I.)
 Kasenit Co., Inc., 13 Park Ave., Highland Mills, NY 10930 914-928-9595; FAX: 914-928-7292
 Kasmarsik Bullets, 4016 7th Ave. SW, Puyallup, WA 98373
 Kaswer Custom, Inc., 13 Surrey Drive, Brookfield, CT 06804 203-775-0564; FAX: 203-775-6872
 K.B.I., Inc., P.O. Box 6625, Harrisburg, PA 17112 717-8518; FAX: 717-540-8567
 K-D, Inc., Box 459, 585 N. Hwy. 155, Cleveland, UT 84518 801-653-2530
 KDF, Inc., 2485 Hwy. 46 N., Seguin, TX 78155 210- 379-8141; FAX: 210-379-5420
 KeeCo Impressions, Inc., 346 Wood Ave., North Brunswick, NJ 08902 800-468-0546
 Keeler, R.H., 817 "N" St., Port Angeles, WA 98362 206-457-4702
 Kehr, Roger, 2131 Agate Ct. SE, Lacey, WA 98503 360- 456-0831
 Keith's Bullets, 942 T wisted Oak, Algonquin, IL 60102 708-658-3520
 Keith's Custom Gunstocks (See Heppler, Keith M.)
 Kelbly, Inc., 7222 Dalton Fox Lake Rd., North Lawrence, OH 44666 216-683-4674; FAX: 216-683- 7349
 Keller Co., The, 4215 McEwen Rd., Dallas, TX 75244 214-770-8585
 Kelley's, P.O. Box 125, Woburn, MA 01801 617-935- 3389
 Kellogg's Professional Products, 325 Pearl St., Sandusky, OH 44870 419-625-6551; FAX: 419-625- 6167
 Kelly, Lance, 1723 Willow Oak Dr., Edgewater, FL 32132 904-423-4933
 Kel-Tec CNC Industries, Inc., P.O. Box 3427, Cocoa, FL 32924 407-631-0068; FAX: 407-631-1169
 Kemen America, 2550 Hwy. 23, Wrenshall, MN 55797
 Ken's Kustom Kartridges, 331 Jacobs Rd., Hubbard, OH 44425 216-534-4595
 Ken's Gun Specialties, Rt. 1, Box 147, Lakeview, AR 72642 501-431-5606
 Ken's Rifle Blanks, Ken McCullough, Rt. 2, P.O. Box 85B, Weston, OR 97886 503-566-3879
 Keng's Firearms Specialty, Inc., 875 Wharton Dr., P.O. Box 44405, Atlanta, GA 30336-1405 404-691-7611; FAX: 404-505-8445
 Kennebec Journal, 274 Western Ave., Augusta, ME 04330 207-622-6288
 Kennedy Firearms, 10N. Market St., Muncy, PA 17756 717-546-6695
 KenPatable Ent., Inc., P.O. Box 19422, Louisville, KY 40259 502-239-5447
 Kent Cartridge Mfg. Co. Ltd., Unit 16, Branbridges Industrial Estate, East, Peckham Tonbridge, Kent, TN12 5HF ENGLAND
 872255; FAX: 622-872645
 Keowee Game Calls, 608 Hwy. 25 North, Travelers Rest, SC 29690 864-834-7204; FAX: 864-834-7831
 Kershaw Knives, 25300 SW Parkway Ave., Wilsonville, OR 97070 503-682-1966, 800-325- 2891; FAX: 503-682-7168
 Kesselring Gun Shop, 400 Hwy. 99 North, Burlington, WA 98233 206-724-3113; FAX: 206-724-7003
 Ketchum, Jim (See Jim's Precision)
 Kick Eez, P.O. Box 12767, Wichita, KS 67277 316- 721-9570; FAX: 316-721-5260
 Kilham & Co., Main St., P.O. Box 37, Lyme, NH 03768 603-795-4112
 Kimar (See U.S. importer—IAR, Inc.)
 Kimball, Gary, 1526 N. Circle Dr., Colorado Springs, CO 80909 719-634-1274
 Kimber of America, Inc., 1 Lawton St., Yonkers, NY 10705 800-880-2418
 King & Co., P.O. Box 1242, Bloomington, IL 61702 309-473-3964
 King's Gun Works, 1837 W. Glenoaks Blvd., Glendale, CA 91201 818-956-6010; FAX: 818-548-8606
 Kingyon, Paul L. (See Custom Calls)
 Kirk Game Calls, Inc., Dennis, RD1, Box 184, Laurens, NY 13796 607-433-2710; FAX: 607-433-2711
 Kirkpatrick Leather Co., 1910 San Bernardo, Laredo, TX 78040 210-723-6631; FAX: 210-725-0672
 KJM Fabritek, Inc., P.O. Box 162, Marietta, GA 30061 770-426-8251; FAX: 770-426-8252
 KK Air International (See Impact Case Co.)
 K.K. Arms Co., Star Route Box 671, Kerrville, TX 78028 210-257-4718; FAX: 210-257-4891

KLA Enterprises, P.O. Box 2028, Eaton Park, FL 33840 682-2829; FAX: 941-682-2829
 Kleen-Bore, Inc., 16 Industrial Pkwy., Easthampton, MA 01027 413-527-0300; FAX: 413-527-2522
 Klein Custom Guns, Don, 433 Murray Park Dr., Ripon, WI 54971 414-748-2931
 Kleinendorst, K.W., RR 1, Box 1500, Hop Bottom, PA 18824 717-289-4687
 Klingler Woodcarving, P.O. Box 141, Thistle Hill, Cabot, VT 05647 802-426-3811
 Kmount, P.O. Box 19422, Louisville, KY 40259 502-239-5447
 Kneiper, James, P.O. Box 1516, Basalt, CO 81621 -1516 303-963-9880
 Knife Importers, Inc., P.O. Box 1000, Manchaca, TX 78652 512-282-6860
 Knight & Hale Game Calls, Box 468 Industrial Park, Cadiz, KY 42211 502-924-1755; FAX: 502-924-1763
 Knight Rifles (See Modern MuzzleLoading, Inc.)
 Knight's Mfg. Co., 7750 9th St. SW, Vero Beach, FL 32968 561-562-5697; FAX: 561-569-2955
 Knippel, Richard, 1455 Jubal Ct., Oakdale, CA 95361-9669 209-869-1469
 Knock on Wood Antiques, 355 Post Rd., Darien, CT 06820 203-655-9031
 Knoell, Doug, 9737 McCardle Way, Santee, CA 92071
 Kodiak Custom Bullets, 8261 Henry Circle, Anchorage, AK 99507 907-349-2282
 Koevenig's Engraving Service, Box 55 Rabbit Gulch, Hill City, SD 57745
 KOGOT, 410 College, Trinidad, CO 81082 719-846-9406
 Kokolus, Michael M. (See Custom Riflestocks, Inc.)
 Kolpin Mfg., Inc., P.O. Box 107, 205 Depot St., Fox Lake, WI 53933 414-928-3118; FAX: 414-928-3687
 Kongsberg America L.L.C., P.O. Box 252, Fairfield, CT 06430 203-259-0938; FAX: 203-259-2566
 Kopec Enterprises, John (See Peacemaker Specialists)
 Kopp Professional Gunsmithing, Terry K., Route 1, Box 224F, Lexington, MO 64067 816-259-2636
 Korth, Robert-Bosch-Str. 4, P.O. Box 1320, 23909 Ratzeburg, GERMANY 451-4991497; FAX: 451-4993230 (U.S. importer—Interarms; Mandall Shooting Supplies, Inc.)
 Korzinek Riflesmith, J., RD 2, Box 73D, Canton, PA 17724 717-673-8512
 Koval Knives, 5819 Zarley St., Suite A, New Albany, OH 43054 614-855-0777; FAX: 614-855-0945
 Kowa Optimed, Inc., 20001 S. Vermont Ave., Torrance, CA 90502 310-327-1913; FAX: 310-327-4177
 Kramer Designs, P.O. Box 129, Clancy, MT 59634 933-8658; FAX: 406-933-8658
 Kramer Handgun Leather, P.O. Box 112154, Tacoma, WA 98411 206-564-6652; FAX: 206-564-1214
 Krause Publications, Inc., 700 E. State St., Iola, WI 54990 715-445-2214; FAX: 715-445-4087; Consumer orders only 800-258-0929
 Krico Jagd-und Sportwaffen GmbH, Numbergerstrasse 6, D-90602 Pyrbaum GERMANY 09180-2780; FAX: 09180-2661 (U.S. importer—Mandall Shooting Supplies, Inc.)
 Krieger Barrels, Inc., N114 W18697 Clinton Dr., Germantown, WI 53022 414-255-9593; FAX: 414-255-9586
 Krieghoff Gun Co., H., Boschstrasse 22, D-89079 Ulm, GERMANY 731-401820; FAX: 731-4018270 (U.S. importer—Krieghoff International, Inc.)
 Krieghoff International, Inc., 7528 Easton Rd., Ottsville, PA 18942 610-847-5173; FAX: 610-847-8691
 Kris Mounts, 108 Lehigh St., Johnstown, PA 15905 814-539-9751
 KSN Industries, Ltd. (See U.S. importer—Israel Arms International, Inc.)
 K-Sports Imports, Inc., 2755 Thompson Creek Rd., Pomona, CA 91767 909-392-2345; FAX: 909-392-2354
 Kudlas, John M., 622 14th St. SE, Rochester, MN 55904 507-288-5579
 Kulis Freeze Dry Taxidermy, 725 Broadway Ave., Bedford, OH 44146 216-232-8352; FAX: 216-232-7305; WEB: <http://www.kastaway.com>; E-Mail: jkulis@kastaway.com
 KVH Industries, Inc., 110 Enterprise Center, Middletown, RI 02842 401-847-3327; FAX: 401-849-0045
 Kwik Mount Corp., P.O. Box 19422, Louisville, KY 40259 502-239-5447
 Kwik-Site Co., 5555 Treadwell, Wayne, MI 48184 313-326-1500; FAX: 313-326-4120

L

L&R Lock Co., 1137 Pocalla Rd., Sumter, SC 29150 775-6127; FAX: 803-775-5171
 L&S Technologies, Inc. (See Aimtech Mount Systems)
 La Clinique du .45, 1432 Rougemont, Chambly, Quebec, J3L 2L8 CANADA 514-658-1144
 Labanu, Inc., 2201-F Fifth Ave., Ronkonkoma, NY 11779 516-467-6197; FAX: 516-981-4112
 LaBounty Precision Reboring, P.O. Box 186, 7968 Silver Lk. Rd., Maple Falls, WA 98266 360-599-2047
 LaCrosse Footwear, Inc., P.O. Box 1328, LaCrosse, WI 54602 608-782-3020, 800-323-2668; FAX: 800-658-9444
 Lady Clays, P.O. Box 457, Shawnee Mission, KS 66201 913-268-8006
 LaFrance Specialties, P.O. Box 178211, San Diego, CA 92177-8211 619-293-3373
 Lage Uniwad, P.O. Box 2302, Davenport, IA 52809 319-388-LAGE; FAX: 319-388-LAGE

Lair, Sam, 520 E. Beaver, Jenks, OK 74037 918-299- 2391
Lake Center, P.O. Box 38, St. Charles, MO 63302 314- 946-7500
Lakefield Arms Ltd. (See Savage Arms, Inc.)
Lakewood Products, LLC, 275 June St., Berlin, WI 54923 800-US-BUILT; FAX: 414-361-7719
Lampert, Ron, Rt. 1, Box 177, Guthrie, MN 56461 218-854-7345
Lamson & Goodnow Mfg. Co., 45 Conway St., Shelburne Falls, MA 03170 413-625-6331; FAX: 413-625-9816
Lanber Armas, S.A., Zubiaurre 5, Zaldibar, SPAIN 48250 34-4-6827702; FAX: 34-4-6827999
Lane Bullets, Inc., 1011 S. 10th St., Kansas City, KS 66105 913-621 -6113, 800-444-7468
Lane Publishing, P.O. Box 459, Lake Hamilton, AR 71951 501-525-7514; FAX: 501-525-7519
Langenberg Hat Co., P.O. Box 1860, Washington, MO 63090 800-428-1860; FAX: 314-239-3151
Lanphert, Paul, P.O. Box 1985, Wenatchee, WA 98807
Lapua Ltd., P.O. Box 5, Lapua, FINLAND SF-62101 6- 310111; FAX: 6-4388991 (U.S. importer—Keng's Firearms Specialty, Inc.)
L.A.R. Mfg., Inc., 4133 W. Farm Rd., West Jordan, UT 84088 801-280-3505; FAX: 801-280-1972
LaRocca Gun Works, Inc., 51 Union Place, Worcester, MA 01608 508-754-2887; FAX: 508-754-2887
Laseraim Technologies, Inc., P.O. Box 3548, Little Rock, AR 72203 501-375-2227; FAX: 501-372-1445
Laser Devices, Inc., 2 Harris Ct. A-4, Monterey, CA 93940 408-373-0701; FAX: 408-373-0903
LaserMax, Inc., 3495 Winton Place, Bldg. B, Rochester, NY 14623-2807 716-272-5420; FAX: 716-272-5427
Lassen Community College, Gunsmithing Dept., P.O. Box 3000, Hwy. 139, Susanville, CA 96130 916-251- 8800; FAX: 916-251-8838
Lathrop's, Inc., 5146 E. Pima, Tucson, AZ 85712 520- 881-0266, 800-875-4867; FAX: 520-322-5704
Laughridge, William R. (See Cylinder & Slide, Inc.)
Laurel Mountain Forge, P.O. Box 224C, Romeo, MI 48065 810-749-5742
Laurona Armas Eibar, S.A.L., Avenida de Otaola 25, P.O. Box 260, 20600 Eibar, SPAIN 34-43-700600; FAX: 34-43-700616 (U.S. importer—Galaxy Imports Ltd., Inc.)
Law Concealment Systems, Inc., P.O. Box 3952, Wilmington, NC 28406 919-791-6656, 800-373-0116 orders; FAX: 910-791-8388
Lawrence Brand Shot (See Precision Reloading, Inc.)
Lawrence Leather Co., P.O. Box 1479, Lillington, NC 27546 910-893-2071; FAX: 910-893-4742
Lawson Co., Harry, 3328 N. Richey Blvd., Tucson, AZ 85716 520-326-1117
Lawson, John G. (See Sight Shop, The)
Lazzeroni Arms Co., 1415 S. Cherry Ave., Tucson, AZ 85726 520-577-7500; FAX: 520-624-4250
LBT, HCR 62, Box 145, Moyie Springs, ID 83845 208- 267-3588
Le Clear Industries (See E-Z-Way Systems)
Lea Mfg. Co., 237 E. Aurora St., Waterbury, CT 06720 203-753-5116
Lead Bullets Technology (See LBT)
Leapers, Inc., 7675 Five Mile Rd., Northville, MI 48167 810-486-1231; FAX: 810-486-1430
Leather Arsenal, 27549 Middleton Rd., Middleton, ID 83644 208-585-6212
Leatherman Tool Group, Inc., 12106 NE Ainsworth Cir., P.O. Box 20595, Portland, OR 97294 503-253- 7826; FAX: 503-253-7830
Lebeau-Courally, Rue St. Gilles, 386, 4000 Liege, BELGIUM 042-52-48-43; FAX: 32-042-52-20-08 (U.S. importer—New England Arms Co.)
Leckie Professional Gunsmithing, 546 Quarry Rd., Ottsville, PA 18942 215-847-8594
Lectro Science, Inc., 6410 W. Ridge Rd., Erie, PA 16506 814-833-6487; FAX: 814-833-0447
Ledbetter Airguns, Riley, 1804 E. Sprague St., Winston Salem, NC 27107-3521 919-784-0676
Lee Precision, Inc., 4275 Hwy. U, Hartford, WI 53027
673-3075; FAX: 414-673-9273
Lee Supplies, Mark, 9901 France Ct., Lakeville, MN 55044 612-461-2114
Lee's Red Ramps, 4 Kristine Ln., Silver City, NM 88061 505-538-8529
Lee Co., T.K., One Independence Plaza, Suite 520, Birmingham, AL 35209 205-913-5222
LeFever Arms Co., Inc., 6234 Stokes, Lee Center Rd., Lee Center, NY 13363 315-337-6722; FAX: 315-337- 1543
Legend Products Corp., 21218 Saint Andrews Blvd., Boca Raton, FL 33433-2435
Leibowitz, Leonard, 1205 Murrayhill Ave., Pittsburgh, PA 15217 412-361-5455
Leica USA, Inc., 156 Ludlow Ave., Northvale, NJ 07647 201-767-7500; FAX: 201-767-8666
LEM Gun Specialties, Inc., The Lewis Lead Remover, P.O. Box 2855, Peachtree City, GA 30269-2024
Lem Sports, Inc., P.O. Box 2107, Aurora, IL 60506 286-7421, 800-688-8801 (orders only)
Lenahan Family Enterprise, P.O. Box 46, Manitou Springs, CO 80829
Lestrom Laboratories, Inc., P.O. Box 628, Mexico, NY 13114-0628 315-343-3076; FAX: 315-592-3370
Lethal Force Institute (See Police Bookshelf)
Lett Custom Grips, 672 Currier Rd., Hopkinton, NH 03229-2652
Leupold & Stevens, Inc., P.O. Box 688, Beaverton, OR 97075 503-646-9171; FAX: 503-526-1455

Lever Arms Service Ltd., 2131 Burrard St., Vancouver, C. V6J 3H7 CANADA 604-736-0004; FAX: 604- 738-3503
 Lewis Lead Remover, The (See LEM Gun Specialties, Inc.)
 Liberty Antique Gunworks, 19 Key St., P.O. Box 183, Eastport, ME 04631 207-853-4116
 Liberty Metals, 2233 East 16th St., Los Angeles, CA 90021 213-581-9171; FAX: 213-581-9351
 Liberty Safe, 1060 N. Spring Creek PL, Springville, UT 84663 800-247-5625; FAX: 801-489-6409
 Liberty Shooting Supplies, P.O. Box 357, Hillsboro, OR 97123 503-640-5518
 Liberty Trouser Co., 3500 6 Ave S., Birmingham, AL 35222-2406 205-251-9143
 Light Optronics (See TacStar Industries, Inc.)
 Lightfield Ammunition Corp. (See Slug Group, Inc.)
 Lightforce U.S.A. Inc., 19226 66th Ave. So., L-103, Kent, WA 98032 206-656-1577; FAX: 206-656-1578
 Lightning Performance Innovations, Inc., RD1 Box 555, Mohawk, NY 13407 315-866-8819, 800-242- 5873; FAX: 315-866-8819
 Lilja Precision Rifle Barrels, P.O. Box 372, Plains, MT 406-826-3084; FAX: 406-826-3083
 Lincoln, Dean, Box 1886, Farmington, NM 87401
 Lind Custom Guns, Al, 7821 76th Ave. SW, Tacoma, WA 98498 206-584-6361
 Linder Solingen Knives, 4401 Sentry Dr., Tucker, GA 30084 770-939-6915; FAX: 770-939-6738
 Lindsay, Steve, RR 2 Cedar Hills, Kearney, NE 68847 308-236-7885
 Lindsley Arms Cartridge Co., P.O. Box 757, 20 College Hill Rd., Henniker, NH 03242 603-428-3127
 Linebaugh Custom Sixguns, Route 2, Box 100, Maryville, MO 64468 816-562-3031
 Lion Country Supply, P.O. Box 480, Port Matilda, PA 16870
 List Precision Engineering, Unit 1, Ingley Works, 13 River Road, Barking, Essex IG11 0HE ENGLAND 011-081-594-1686
 Lithi Bee Bullet Lube, 1728 Carr Rd., Muskegon, MI 49442 616-788-4479
 "Little John's" Antique Arms, 1740 W. Laveta, Orange, CA 92668
 Little Trees Ramble (See Scott Pilkington, Little Trees Ramble)
 Littler Sales Co., 20815 W. Chicago, Detroit, MI 48228 273-6889; FAX: 313-273-1099
 Littleton, J.F., 275 Pinedale Ave., Oroville, CA 95966 916-533-6084
 Ljutic Industries, Inc., 732 N. 16th Ave., Suite 22, Yakima, WA 98902 509-248-0476; FAX: 509-576- 8233
 Llama Gabilondo Y Cia, Apartado 290, E-01080, Victoria, SPAIN (U.S. importer—Import Sports, Inc.)
 L.L. Bean, Inc., Freeport, ME 04032, 207-865-4761; FAX: 207-552-2802
 Load From A Disk, 9826 Sagedale, Houston, TX 77089 484-0935; FAX: 281-484-0935
 Loch Leven Industries, P.O. Box 2751, Santa Rosa, CA 95405 707-573-8735; FAX: 707-573-0369
 Lock's Philadelphia Gun Exchange, 6700 Rowland Ave., Philadelphia, PA 19149 215-332-6225; FAX: 215-332-4800
 Lodewick, Walter H., 2816 NE Halsey St., Portland, OR 97232 503-284-2554
 Log Cabin Sport Shop, 8010 Lafayette Rd., Lodi, OH 44254 216-948-1082
 Logan, Harry M., Box 745, Honokaa, HI 96727 808- 776-1644
 Lohman Mfg. Co., Inc., 4500 Doniphan Dr., P.O. Box 220, Neosho, MO 64850 417-451-4438; FAX: 417-451-2576
 Lomont Precision Bullets, RR 1, Box 34, Salmon, ID 83467 208-756-6819; FAX: 208-756-6824
 London Guns Ltd., Box 3750, Santa Barbara, CA 93130 683-4141; FAX: 805-683-1712
 Lone Star Gunleather, 1301 Brushy Bend Dr., Round Rock, TX 78681 512-255-1805
 Lone Star Rifle Company, 11231 Rose Road, Conroe, Texas 77303 409-856-3363
 Long, George F., 1500 Rogue River Hwy., Ste. F, Grants Pass, OR 97527 541-476-7552
 Lorcin Engineering Co., Inc., 10427 San Sevaine Way, Ste. A, Mira Loma, CA 91752
 Lortone, Inc., 2856 NW Market St., Seattle, WA 98107 206-789-3100
 Lothar Walther Precision Tool, Inc., 2190 Coffee Rd., Lithonia, GA 30058 770-482-4253; Fax: 770-482- 9344
 Lovestrand, Erik, 206 Bent Oak Circle, Harvest, AL 35749-9334
 Loweth (Firearms), Richard H.R., 29 Hedgegrow Lane, Kirby Muxloe, Leics. LE9 2BN ENGLAND (0)116 238 6295
 L.P.A. Snc, Via Alfieri 26, Gardone V.T., Brescia, ITALY 25063 30-891-14-81; FAX: 30-891-09-51
 LPS Laboratories, Inc., 4647 Hugh Howell Rd., P.O. Box 3050, Tucker, GA 30084 404-934-7800
 Lucas, Edward E., 32 Garfield Ave., East Brunswick, NJ 08816 201-251-5526
 Lucas, Mike, 1631 Jessamine Rd., Lexington, SC 29073 803-356-0282
 Luch Metal Merchants, Barbara, 48861 West Rd., Wixom, MI 48393 800-876-5337
 Lutz Engraving, Ron, E. 1998 Smokey Valley Rd., Scandinavia, WI 54977 715-467-2674
 Lyman Instant Targets, Inc. (See Lyman Products Corp.)

Lyman Products Corp., 475 Smith Street, Middletown, CT 06457-1541 860-632-2020, 800-22-LYMAN; FAX: 860-632-1699
 Lynn's Custom Gunstocks, RR 1, Brandon, IA 52210 319-474-2453
 Lyons Gunworks, Larry, 110 Hamilton St., Dowagiac, MI 49047 616-782-9478
 Lyte Optronics (See TracStar Industries, Inc.)

M

M&D Munitions Ltd., 127 Verdi St., Farmingdale, NY 11735 800-878-2788, 516-752-1038; FAX: 516-752- 1905
 M&M Engineering (See Hollywood Engineering)
 M&N Bullet Lube, P.O. Box 495, 151 NE Jefferson St., Madras, OR 97741 503-255-3750
 MA Systems, P.O. Box 1143, Chouteau, OK 74337 918-479-6378
 Mac-1 Distributors, 13974 Van Ness Ave., Gardena, CA 90249 310-327-3582
 Mac's .45 Shop, P.O. Box 2028, Seal Beach, CA 90740 310-438-5046
 Macbean, Stan, 754 North 1200 West, Orem, UT 84057 801-224-6446
 Madis Books, 2453 West Five Mile Pkwy., Dallas, TX 214-330-7168
 Madis, George, P.O. Box 545, Brownsboro, TX 75756 903-852-6480
 MAG Instrument, Inc., 1635 S. Sacramento Ave., Ontario, CA 91761 909-947-1006; FAX: 909-947- 3116
 Mag-Na-Port International, Inc., 41302 Executive Dr., Harrison Twp., MI 48045-1306 810-469-6727; FAX: 810-469-0425
 Mag-Pack Corp., P.O. Box 846, Chesterland, OH 44026
 Magma Engineering Co., P.O. Box 161, 20955 E. Ocotillo Rd., Queen Creek, AZ 85242 602-987-9008; FAX: 602-987-0148
 Magnolia Sports, Inc., 211 W. Main, Magnolia, AR 71753 501-234-8410, 800-530-7816; FAX: 501-234- 8117
 Magnum Grips, Box 801G, Payson, AZ 85547
 Magnum Power Products, Inc., P.O. Box 17768, Fountain Hills, AZ 85268
 Magnum Research, Inc., 7110 University Ave. NE, Minneapolis, MN 55432 800-772-6168, 612-574- 1868; FAX: 612-574-0109;
 WEB: <http://www.magnumresearch.com>
 Magnus Bullets, P.O. Box 239, Toney, AL 35773 205-8359; FAX: 205-420-8360
 MagSafe Ammo Co., 2725 Friendly Grove Rd NE, Olympia, WA 98506 360-357-6383; FAX: 360-705- 4715
 MagTech Recreational Products, Inc., 5030 Paradise Rd., Suite A104, Las Vegas, NV 89119 702-736- 2043; FAX: 702-736-2140
 Mahony, Philip Bruce, 67 White Hollow Rd., Lime Rock, CT 06039-2418 203-435-9341
 Mahovsky's Metalife, R.D. 1, Box 149a Eureka Road, Grand Valley, PA 16420 814-436-7747
 Maine Custom Bullets, RFD 1, Box 1755, Brooks, ME 04921
 Maionchi-L.M.I., Via Di Coselli-Zona Industriale Di Guamo, Lucca, ITALY 55060 011 39-583 94291
 Makinson, Nicholas, RR 3, Komoka, Ont. N0L 1R0 CANADA 519-471-5462
 Malcolm Enterprises, 1023 E. Prien Lake Rd., Lake Charles, LA 70601
 Mallardtone Game Calls, 2901 16th St., Moline, IL 61265 309-762-8089
 M.A.M. Products, Inc., 153 B Cross Slope Court, Englishtown, NJ 07726 908-536-3604; FAX: 908- 972-1004
 Mandall Shooting Supplies, Inc., 3616 N. Scottsdale Rd., Scottsdale, AZ 85252 602-945-2553; FAX: 602-949-0734
 Manufacture D'Armes Des Pyrenees Francaises (See Unique M.A.P.F.)
 Mar Knives, Inc., Al, 5755 SW Jean Rd., Suite 101, Lake Oswego, OR 97035 503-635-9229; FAX: 503- 223-0467
 Marathon Rubber Prods. Co., Inc., 510 Sherman St., Wausau, WI 54401 715-845-6255
 Marble Arms (See CRR, Inc., Marble's Inc.) Marchmon Bullets, 8191 Woodland Shore Dr., Brighton, MI 48116
 Marent, Rudolf, 9711 Tiltree St., Houston, TX 77075 713-946-7028
 Markell, Inc., 422 Larkfield Center 235, Santa Rosa, CA 95403 707-573-0792; FAX: 707-573-9867
 Markesbery Muzzle Loaders, Inc., 7785 Foundation Dr., Ste. 6, Florence, KY 41042 800-875-0121; 606- 342-2380
 Marksman Products, 5482 Argosy Dr., Huntington Beach, CA 92649 714-898-7535, 800-822-8005; FAX: 714-891-0782
 Marlin Firearms Co., 100 Kenna Dr., North Haven, CT 06473 203-239-5621; FAX: 203-234-7991
 MarMik, Inc., 2116 S. Woodland Ave., Michigan City, IN 46360 219-872-7231; FAX: 219-872-7231
 Marocchi F.Ili S.p.A, Via Galileo Galilei 8, 1-25068 Zanano di Sarezzo, ITALY (U.S. importers— Precision Sales International, Inc.)
 Marple & Associates, Dick, 21 Dartmouth St., Hooksett, NH 03106 603-627-1837; FAX: 603-627- 1837
 Marquart Precision Co., P.O. Box 1740, Prescott, AZ 86302 520-445-5646
 Marsh, Johnny, 1007 Drummond Dr., Nashville, TN 37211 615-833-3259
 Marsh, Mike, Croft Cottage, Main St., Elton, Derbyshire DE4 2BY, ENGLAND 01629 650 669

Marshall Enterprises, 792 Canyon Rd., Redwood City, CA 94062
 Martin Bookseller, J., P.O. Drawer AP, Beckley, WV 25802 304-255-4073; FAX: 304-255-4077
 Martin's Gun Shop, 937 S. Sheridan Blvd., Lakewood, CO 80226 303-922-2184
 Martz, John V., 8060 Lakeview Lane, Lincoln, CA 95648 916-645-2250
 Marvel, Alan, 3922 Madonna Rd., Jarrettsville, MD 21084 301-557-6545
 Marx, Harry (U.S. importer for FERLIB)
 Maryland Paintball Supply, 8507 Harford Rd., Parkville, MD 21234 410-882-5607
 Masen Co., Inc., John, 1305 Jelmak, Grand Prairie, TX 75050 817-430-8732; FAX: 817-430-1715
 MAST Technology, 4350 S. Arville, Suite 3, Las Vegas, NV 89103 702-362-5043; FAX: 702-362-9554
 Master Engravers, Inc. (See Hendricks, Frank E.)
 Master Lock Co., 2600 N. 32nd St., Milwaukee, WI 53245 414-444-2800
 Master Products, Inc. (See Gun-Alert Master Products, Inc.)
 Match Prep—Doyle Gracey, P.O. Box 155, Tehachapi, CA 93581 805-822-5383
 Mateo, Inc., 1003-2nd St., N. Manchester, IN 46962 219-982-8282
 Mathews & Son, George E., Inc., 10224 S. Paramount Blvd., Downey, CA 90241 562-862-6719; FAX: 562-862-6719
 Matthews Cutlery, 4401 Sentry Dr., Tucker, GA 30084 770-939-6915
 Mauser Werke Obemdorf Waffensysteme GmbH, Postfach 1349, 78722 Obemdorf N. GERMANY (U.S. importer—GSI, Inc.)
 Maverick Arms, Inc., 7 Grasso Ave., P.O. Box 497, North Haven, CT 06473 203-230-5300; FAX: 203-230-5420
 Maxi-Mount, P.O. Box 291, Willoughby Hills, OH 44094-0291 216-944-9456; FAX: 216-944-9456
 Maximum Security Corp., 32841 Calle Perfecto, San Juan Capistrano, CA 92675 714-493-3684; FAX: 714-496-7733
 Mayville Engineering Co. (See MEC, Inc.)
 Mazur Restoration, Pete, 13083 Drummer Way, Grass Valley, CA 95949 916-268-2412
 MCA Sports, P.O. Box 8868, Palm Springs, CA 92263 619-770-2005
 McBros Rifle Co., P.O. Box 86549, Phoenix, AZ 85080 602-582-3713; FAX: 602-581-3825
 McCament, Jay, 1730-134th St. Ct. S., Tacoma, WA 98444 206-531-8832
 McCann's Machine & Gun Shop, P.O. Box 641, Spanaway, WA 98387 206-537-6919; FAX: 206-537-6993
 McCann's Muzzle-Gun Works, 14 Walton Dr., New Hope, PA 18938 215-862-2728
 McCluskey Precision Rifles, 10502 14th Ave. NW, Seattle, WA 98177 206-781-2776
 McCombs, Leo, 1862 White Cemetery Rd., Patriot, OH 45658 614-256-1714
 McCormick Corp., Chip, 1825 Fortview Rd., Ste. 115, Austin, TX 78704 800-328-CHIP, 512-462-0004; FAX: 512-462-0009
 McCullough, Ken (See Ken's Rifle Blanks)
 McDonald, Dennis, 8359 Brady St., Peosta, IA 52068 319-556-7940
 McFarland, Stan, 2221 Idella Ct., Grand Junction, CO 81505 970-243-4704
 McGowen Rifle Barrels, 5961 Spruce Lane, St. Anne, IL 60964 815-937-9816; FAX: 815-937-4024
 McGuire, Bill, 1600 N. Eastmont Ave., East Wenatchee, WA 98802 509-884-6021
 McKee Publications, 121 Eatons Neck Rd., Northport, NY 11768 516-575-8850
 McKenzie, Lynton, 6940 N. Alvemon Way, Tucson, AZ 85718 520-299-5090
 McKillen & Heyer, Inc., 35535 Euclid Ave. Suite 11, Willoughby, OH 44094 216-942-2044
 McKinney, R.P. (See Schuetzen Gun Co.)
 McMillan Fiberglass Stocks, Inc., 21421 N. 14th Ave., Suite B, Phoenix, AZ 85027 602-582-9635; FAX: 602-581-3825
 McMillan Optical Gunsight Co., 28638 N. 42nd St., Cave Creek, AZ 85331 602-585-7868; FAX: 602-585-7872
 McMillan Rifle Barrels, P.O. Box 3427, Bryan, TX 77805 409-690-3456; FAX: 409-690-0156
 McMurdo, Lynn (See Specialty Gunsmithing)
 MCRW Associates Shooting Supplies, R.R. 1 Box 1425, Sweet Valley, PA 18656 717-864-3967; FAX: 717-864-2669
 MCS, Inc., 34 Delmar Dr., Brookfield, CT 06804 203-775-1013; FAX: 203-775-9462
 McWelco Products, 6730 Santa Fe Ave., Hesperia, CA 92345 619-244-8876; FAX: 619-244-9398
 McWhorter Custom Rifles, 4460 SW 35th Terrace, Suite 310, Gainesville, FL 32608 352-373-9057; FAX: 352-377-3816
 MDS, P.O. Box 1441, Brandon, FL 33509-1441 813-653-1180; FAX: 813-684-5953
 Meadow Industries, 24 Club Lane, Palmyra, VA 22963 589-7672; FAX: 804-589-7672
 Measurement Group, Inc., Box 27777, Raleigh, NC 27611
 MEC, Inc., 715 South St., Mayville, WI 53050 414-4500; FAX: 414-387-5802
 MEC-Gar S.r.l., Via Madonnina 64, Gardone V.T., Brescia, ITALY 25063 39-30-8912687; FAX: 39-30-8910065 (U.S. importer—MEC-Gar U.S.A., Inc.)
 MEC-Gar U.S.A., Inc., Box 112, 500B Monroe Turnpike, Monroe, CT 06468 203-635-8662; FAX: 203-635-8662

Meier Works, P.O. Box 423, Tijeras, NM 87059 SOS- 281-3783
 Meister Bullets (See Gander Mountain)
 Mele, Frank, 201 S. Wellow Ave., Cookeville, TN 38501 615-526-4860
 Melton Shirt Co., Inc., 56 Harvester Ave., Batavia, NY 14020 716-343-8750; FAX: 716-343-6887
 Men-Metallwerk Elisenhuetten, GmbH, P.O. Box 1263, D-56372 Nassau Lahn, GERMANY 2604-7819
 Menck, Gunsmith Inc., T.W., 5703 S. 77th St., Ralston, NE 68127
 Mendez, John A., P.O. Box 620984, Orlando, FL 32862 407-344-2791
 Meprolight (See Hesco-Meprolight)
 Mercer Custom Stocks, R.M., 216 S. Whitewater Ave., Jefferson, WI 53549 414-674-5130
 Merit Corp., Box 9044, Schenectady, NY 12309 518-346-1420
 Merkel Freres, Strasse 7 October, 10, Suhl, GERMANY (U.S. importer—GSI, Inc.)
 Merkuria Ltd., Argentinska 38, 17005 Praha 7, CZECH REPUBLIC 422-875117; FAX: 422-809152
 Metal Merchants, 48861 West Rd., Wixom, MI 48393
 Metal Products Co. (See MPC)
 Metalife Industries (See Mahovsky's Metalife)
 Metaloy Inc., Rt. 5, Box 595, Berryville, AR 72616 501-545-3611
 Metals Hand Engraver European Hand Engraving, Ste. 216, 12 South First St., San Jose, CA 95113 408-293- 6559
 Michael's Antiques, Box 591, Waldoboro, ME 04572
 Michaels of Oregon Co., P.O. Box 13010, Portland, OR 97213 503-255-6890; FAX: 503-255-0746
 Micro Sight Co., 242 Harbor Blvd., Belmont, CA 94002 591-0769; FAX: 415-591-7531
 Microfusion Alfa S.A., Paseo San Andres N8, P.O. Box 271, Eibar, SPAIN 20600 34-43-11-89-16; FAX: 34- 43-11-40-38
 Mid-America Guns and Ammo, 1205 W. Jefferson, Suite E, Effingham, IL 62401 800-820-5177
 Mid-America Recreation, Inc., 1328 5th Ave., Moline, IL 61265 309-764-5089; FAX: 309-764-2722
 Middlebrooks Custom Shop, 7366 Colonial Trail East, Surry, VA 23883 757-357-0881; FAX: 757-365-0442
 Midway Arms, Inc., 5875 W. Van Horn Tavern Rd., Columbia, MO 65203 800-243-3220, 573-445-6363; FAX: 573-446-1018
 Midwest Gun Sport, 1108 Herbert Dr., Zebulon, NC 27597 919-269-5570
 Midwest Sport Distributors, Box 129, Fayette, MO 65248
 Military Armament Corp., P.O. Box 120, Mt. Zion Rd., Lingleville, TX 76461 817-965-3253
 Miller Arms, Inc., P.O. Box 260 Purl St., St. Onge, SD 57779 605-642-5160; FAX: 605-642-5160
 Miller Custom, 210 E. Julia, Clinton, IL 61727 217- 935-9362
 Miller Co., David, 3131 E. Greenlee Rd., Tucson, AZ 85716-1267 520-326-3117
 Miller Enterprises, Inc., R.P., 1557 E. Main St., P.O. Box 234, Brownsburg, IN 46112 317-852-8187
 Miller Single Trigger Mfg. Co., Rt. 209 Box 1275, Millersburg, PA 17061 717-692-3704
 Millett Sights, 7275 Murdy Circle, Adm. Office, Huntington Beach, CA 92647 714-842-5575, 800- 645-5388; FAX: 714-843-5707
 Mills Jr., Hugh B., 3615 Canterbury Rd., New Bern, NC 28560 919-637-4631
 Milstor Corp., 80-975 E. Valley Pkwy. C-7, Indio, CA 92201 619-775-9998; FAX: 619-772-4990
 Miniature Machine Co. (See MMC)
 Minute Man High Tech Industries, 10611 Canyon Rd. E., Suite 151, Puyallup, WA 98373 800-233-2734
 Mirador Optical Corp., P.O. Box 11614, Marina Del Rey, CA 90295-7614 310-821-5587; FAX: 310-305- 0386
 Miroku, B.C. Daly, Charles (See U.S. importer—Bell's Legendary Country Wear; K.B.I., Inc.; U.S. distributor—Outdoor Sports Headquarters, Inc.) Mitchell Bullets, R.F., 430 Walnut St., Westport, MD 21562
 Mitchell Optics Inc., 2072 CR 1100 N, Sidney, IL 61877 217-688-2219, 217-621-3018; FAX: 217-688- 2505
 Mitchell's Accuracy Shop, 68 Greenridge Dr., Stafford, VA 22554 703-659-0165
 MI-TE Bullets, R.R. 1 Box 230, Ellsworth, KS 67439 913-472-4575
 Mittermeier, Inc., Frank, P.O. Box 2G, 3577 E. Tremont Ave., Bronx, NY 10465 718-828-3843
 Mixson Corp., 7435 W. 19th Ct., Hialeah, FL 33014 305-821-5190, 800-327-0078; FAX: 305-558-9318
 MJK Gunsmithing, Inc., 417 N. Huber Ct., E. Wenatchee, WA 98802 509-884-7683
 MJM Mfg., 3283 Rocky Water Ln. Suite B, San Jose, CA 95148 408-270-4207
 MKS Supply, Inc. (See Hi-Point Firearms)
 MMC, 2513 East Loop 820 North, Ft. Worth, TX 76118 595-0404; FAX: 817-595-3074
 MMP, Rt. 6, Box 384, Harrison, AR 72601 501-741- 5019; FAX: 501-741-3104
 M.O.A. Corp., 2451 Old Camden Pike, Eaton, OH 45320 513-456-3669
 Modern Gun Repair School, P.O. Box 92577, Southlake, TX 76092 800-493-4114; FAX: 800-556- 5112
 Modern MuzzleLoading, Inc., 234 Airport Rd., P.O. Box 130, Centerville, IA 52544 515-856-2626; FAX: 515-856-2628
 Moeller, Steve, 1213 4th St., Fulton, IL 61252 815-589- 2300

Molin Industries, Tru-Nord Division, P.O. Box 365,204 North 9th St., Brainerd, MN 56401 218-829-2870
 Mo's Competitor Supplies (See MCS, Inc.)
 MoLoc Bullets, P.O. Box 2810, Turlock, CA 95381- 2810 209-632-1644
 Monell Custom Guns, 228 Red Mills Rd., Pine Bush, NY 12566 914-744-3021
 Moneymaker Guncraft Corp., 1420 Military Ave., Omaha, NE 68131 402-556-0226
 Montana Armory, Inc. (See C. Sharps Arms Co. Inc.)
 Montana Outfitters, Lewis E. Yearout, 308 Riverview Dr. E., Great Falls, MT 59404 406-761-0859
 Montana Precision Swaging, P.O. Box 4746, Butte, MT 59702 406-782-7502
 Montana Vintage Arms, 2354 Bear Canyon Rd., Bozeman, MT 59715
 Montgomery Community College, P.O. Box 787-GD, Troy, NC 27371 910-576-6222,800-839-6222; FAX: 910-576-2176
 Moore & Co., Wm. Larkin, 8727 E. Via de Commencio, Suite A, Scottsdale, AZ 85258 602-951-8913; FAX: 951-8913
 Morini (See U.S. importers—Mandall Shooting Supplies, Inc.; Nygord Precision Products)
 Morrison Custom Rifles, J.W., 4015 W. Sharon, Phoenix, AZ 85029 602-978-3754
 Morrow, Bud, 11 Hillside Lane, Sheridan, WY 82801- 9729 307-674-8360
 Morton Booth Co., P.O. Box 123, Joplin, MO 64802 417-673-1962; FAX: 417-673-3642
 Moschetti, Mitchell R., P.O. Box 27065, Denver, CO 80227
 Moss Double Tone, Inc., P.O. Box 1112, 2101 S. Kentucky, Sedalia, MO 65301 816-827-0827
 Mossberg & Sons, Inc., O.F, 7 Grasso Ave., North Haven, CT 06473 203-230-5300; FAX: 203-230- 5420
 Mountain Bear Rifle Works, Inc., 100 B Ruritan Rd., Sterling, VA 20164 703-430-0420; FAX: 703-430- 7068
 Mountain Hollow Game Calls, Box 121, Cascade, MD 21719 301-241-3282
 Mountain Plains, Inc., 244 Glass Hollow Rd., Alton, VA 22920 800-687-3000
 Mountain Rifles Inc., P.O. Box 2789, Palmer, AK 99645 907-373-4194; FAX: 907-373-4195
 Mountain South, P.O. Box 381, Barnwell, SC 29812 FAX: 803-259-3227
 Mountain State Muzzleloading Supplies, Inc., Box 154-Rt. 2, Williamstown, WV 26187 304-375-7842; FAX: 304-375-3737
 Mountain States Engraving, Kenneth W. Warren, P.O. Box 2842, Wenatchee, WA 98802 509-663-6123
 Mountain View Sports, Inc., Box 188, Troy, NH 03465 357-9690; FAX: 603-357-9691
 Mowrey Gun Works, P.O. Box 246, Waldron, IN 46182 525-6181; FAX: 317-525-9595
 Mowrey's Guns & Gunsmithing, 119 Fredericks St., Canajoharie, NY 13317 518-673-3483
 MPC, P.O. Box 450, McMinnville, TN 37110-0450 615-473-5513; FAX: 615-473-5516
 MPI Fiberglass Stocks, 5655 NW St. Helens Rd., Portland, OR 97210 503-226-1215; FAX: 503-226- 2661
 MSC Industrial Supply Co., 151 Sunnyside Blvd., Plainview, NY 11803-9915 516-349-0330
 MSR Targets, P.O. Box 1042, West Covina, CA 91793 818-331-7840
 Mt. Alto Outdoor Products, Rt. 735, Howardsville, VA 24562
 Mt. Baldy Bullet Co., 12981 Old Hill City Rd., Keystone, SD 57751-6623 605-666-4725
 M.Thys (See U.S. importer—Champlin Firearms, Inc.)
 MTM Molded Products Co., Inc., 3370 Obco Ct., Dayton, OH 45414 513-890-7461; FAX: 513-890- 1747
 Mulhem, Rick, Rt. 5, Box 152, Rayville, LA 71269 728-2688
 Mullins Ammunition, Rt. 2, Box 304K, Clintwood, VA 24228 540-926-6772; FAX: 540-926-6772
 Mullis Guncraft, 3523 Lawyers Road E., Monroe, NC 28110 704-283-6683
 Multi-Caliber Adapters (See MCA Sports)
 Multiplex International, 26 S. Main St., Concord, NH 03301 FAX: 603-796-2223
 Multipropulseurs, La Bertrandiere, 42580 L'Etrat, FRANCE 77 74 01 30; FAX: 77 93 19 34
 Multi-Scale Charge Ltd., 3269 Niagara Falls Blvd., N. Tonawanda, NY 14120 905-566-1255; FAX: 905- 276-6295
 Mundy, Thomas A., 69 Robbins Road, Somerville, NJ 08876 201-722-2199
 Munsch Gunsmithing, Tommy, Rt. 2, P.O. Box 248, Little Falls, MN 56345 612-632-6695
 Murmur Corp., 2823 N. Westmoreland Ave., Dallas, TX 75222 214-630-5400
 Murphy Co., Inc., R., 13 Groton-Harvard Rd., P.O. Box 376, Ayer, MA 01432 617-772-3481
 Murray State College, 100 Faculty Dr., Tishomingo, OK 73460 405-371-2371 ext. 238
 Muscle Products Corp., 112 Fennell Dr., Butler, PA 16001 800-227-7049,412-283-0567; FAX: 412-283- 8310
 Museum of Historical Arms Inc., 2750 Coral Way, Suite 204, Miami, FL 33145 305-444-9199
 Mushroom Express Bullet Co., 601 W. 6th St., Greenfield, IN 46140-1728 317-462-6332
 Muzzleload Magnum Products (See MMP)
 Muzzleloaders Etcetera, Inc., 9901 Lyndale Ave. S., Bloomington, MN 55420 612-884-1161

MWG Co., P.O. Box 971202, Miami, FL 33197 800- 428-9394, 305-253-8393; FAX: 305-232-1247

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N&J Sales, Lime Kiln Rd., Northford, CT 06472 203- 484-0247
 Nagel's Custom Bullets, 100 Scott St., Baytown, TX 77520-2849
 Nalpak, 1937-C Friendship Drive, El Cajon, CA 92020 619-258-1200
 Napoleon Bonaparte, Inc. (See Metals Hand Engraver)
 Nastoffs 45 Shop, Inc., Steve, 12288 Mahoning Ave., P.O. Box 446, North Jackson, OH 44451 330-538- 2977
 National Bullet Co., 1585 E. 361 St., Eastlake, OH 44095 216-951-1854; FAX: 216-951-7761
 National Security Safe Co., Inc., P.O. Box 39, 620 S. 380 E., American Fork, UT 84003 801-756-7706, 800-544-3829; FAX: 801-756-8043
 National Target Co., 4690 Wyaconda Rd., Rockville, MD 20852 800-827-7060, 301-770-7060; FAX: 301- 770-7892
 Nationwide Airgun Repairs (See Airgun Repair Centre)
 Nationwide Sports Distributors, Inc., 70 James Way, Southampton, PA 18966 215-322-2050, 800-355- 3006; FAX: 702-358-2093
 Naval Ordnance Works, Rt. 2, Box 919, Sheperdstown, WV 25443 304-876-0998
 Navy Arms Co., 689 Bergen Blvd., Ridgefield, NJ 07657 201-945-2500; FAX: 201-945-6859
 N.B.B., Inc., 24 Elliot Rd., Sterling, MA 01564 508- 422-7538, 800-942-9444
 N.C. Ordnance Co., P.O. Box 3254, Wilson, NC 27895 237-2440; FAX: 919-243-9845
 NCP Products, Inc., 3500 12th St. N.W., Canton, OH 44708 330-456-5130; FAX: 330-456-5234
 Necessary Concepts, Inc., P.O. Box 571, Deer Park, NY 11729 516-667-8509; 800-671-8881
 NECO, 1316-67th St., Emeryville, CA 94608 510-450- 0420
 Necromancer Industries, Inc., 14 Communications Way, West Newton, PA 15089 412-872-8722
 NEI Handtools, Inc., 51583 Columbia River Hwy., Scappoose, OR 97056 503-543-6776; FAX: 503-543- 6799; E-MAIL: neiht@mcimail.com
 Nelson, Gary K., 975 Terrace Dr., Oakdale, CA 95361 209-847-4590
 Nelson, Stephen, 7365 NW Spring Creek Dr., Corvallis, OR 97330 541-745-5232
 Nelson Weather-Rite, Inc., 14760 Santa Fe Trail Dr., Lenexa, KS 66215 913-492-3200; FAX: 913-492- 8749
 Nesci Enterprises, Inc., P.O. Box 119, Summit St., East Hampton, CT 06424 203-267-2588
 Nesika Bay Precision, 22239 Big Valley Rd., Poulsbo, WA 98370 206-697-3830
 Nettetstad Gun Works, RR 1, Box 160, Pelican Rapids, MN 56572 218-863-4301
 Neumann GmbH, Am Galgenberg 6, 90575 Langenzenn, GERMANY 09101 8258; FAX: 09101 6356
 Nevada Cartridge Co., 44 Montgomery St., Suite 500, San Francisco, CA 94104 415-925-9394; FAX: 415- 925-9396
 Nevada Pistol Academy Inc., 4610 Blue Diamond Rd., Las Vegas, NV 89139 702-897-1100
 New England Ammunition Co., 1771 Post Rd. East, Suite 223, Westport, CT 06880 203-254-8048
 New England Arms Co., Box 278, Lawrence Lane, Kittery Point, ME 03905 207-439-0593; FAX: 207- 439-6726
 New England Custom Gun Service, 438 Willow Brook Rd., RR2, Box 122W, W. Lebanon, NH 03784 603- 469-3450; FAX: 603-469-3471
 New England Firearms, 60 Industrial Rowe, Gardner, MA 01440 508-632-9393; FAX: 508-632-2300
 New Historians Productions, The, 131 Oak St., Royal Oak, MI 48067 313-544-7544
 New Orleans Jewelers Supply Co., 206 Charters St., New Orleans, LA 70130 504-523-3839; FAX: 504- 523-3836
 New SKB Arms Co., C.P.O. Box 1401, Tokyo, JAPAN 81-3-3943-9550; FAX: 81-3-3943-0695
 New Win Publishing, Inc., 186 Center St., Clinton, NJ 08809 908-735-9701; FAX: 908-735-9703
 Newark Electronics, 4801 N. Ravenswood Ave., Chicago, IL 60640
 Newell, Robert H., 55 Coyote, Los Alamos, NM 87544 505-662-7135
 Newman Gunshop, 119 Miller Rd., Agency, IA 52530 515-937-5775
 NgraveR Co., The, 67 Wawecus Hill Rd., Bozrah, CT 06334 860-823-1533
 Nicholson Custom, 17285 Thomlay Road, Hughesville, MO 65334 816-826-8746
 Nickels, Paul R., 4789 Summerhill Rd., Las Vegas, NV 89121 702-435-5318
 Nicklas, Ted, 5504 Hegel Rd., Goodrich, MI 48438 810-797-4493
 Nic Max, Inc., 535 Midland Ave., Garfield, NJ 07026 201-546-7191; FAX: 201-546-7419
 Niemi Engineering, W.B., Box 126 Center Road, Greensboro, VT 05841 802-533-7180 days, 802-533- 7141 evenings
 Nightforce (See Lightforce U.S.A. Inc.)
 Nikon, Inc., 1300 Walt Whitman Rd., Melville, NY 11747 516-547-8623; FAX: 516-547-0309
 Nitex, Inc., P.O. Box 1706, Uvalde, TX 78801 210- 278-8843

Noble Co., Jim, 1305 Columbia St., Vancouver, WA 98660 360-695-1309; FAX: 360-695-6835
 Noreen, Peter H., 5075 Buena Vista Dr., Belgrade, MT 59714 406-586-7383
 Norica, Avnda Otaola, 16, Apartado 68, 20600 Eibar, SPAIN
 Norin, Dave, Schrank's Smoke & Gun, 2010 Washington St., Waukegan, IL 60085 708-662-4034
 Norinco, 7A, Yun Tan N Beijing, CHINA (U.S. importers—Century International Arms, Inc.; Interarms)
 Norincoptics (See BEC, Inc.)
 Norma Precision AB (See U.S. importers—Dynamit Nobel-RWS Inc.; Paul Co. Inc., The)
 Norman Custom Gunstocks, Jim, 14281 Cane Rd., Valley Center, CA 92082 619-749-6252
 Normark Corp., 10395 Yellow Circle Dr., Minnetonka, MN 55343-9101 612-933-7060; FAX: 612-933-0046
 Norrell Arms, John, 2608 Grist Mill Rd., Little Rock, AR 72207 501-225-7864
 North American Arms, Inc., 2150 South 950 East, Provo, UT 84606-6285 800-821-5783, 801-374- 9990; FAX: 801-374-9998
 North American Correspondence Schools, The Gun Pro School, Oak & Pawney St., Scranton, PA 18515 717- 342-7701
 North American Munitions, P.O. Box 815, Beulah, ND 58523 701-948-2260; FAX: 701-948-2282
 North American Shooting Systems, P.O. Box 306, Osoyoos, B.C. V0H 1V0 CANADA 604-495-3131; FAX: 604-495-2816
 North Devon Firearms Services, 3 North St., Braunton, EX33 1AJ ENGLAND 01271 813624; FAX: 01271 813624
 North Fork Custom Gunsmithing, James Johnston, 428 Del Rio Rd., Roseburg, OR 97470 503-673-4467
 North Mountain Pine Training Center (See Executive Protection Institute)
 North Specialty Products, 2664-B Saturn St., Brea, CA 92621 714-524-1665
 North Star West, P.O. Box 488, Glencoe, CA 95232 209-293-7010
 North Wind Decoy Co., 1005 N. Tower Rd., Fergus Falls, MN 56537 218-736-4378; FAX: 218-736-7060
 Northern Precision Custom Swaged Bullets, 329 S. James St., Carthage, NY 13619 315-493-1711
 Northlake Outdoor Footwear, P.O. Box 10, Franklin, TN 37065-0010 615-794-1556; FAX: 615-790-8005
 Northside Gun Shop, 2725 NW 109th, Oklahoma City, OK 73120 405-840-2353
 No-Sho Mfg. Co., 10727 Glenfield Ct., Houston, TX 77096 713-723-5332
 Nosier, Inc., P.O. Box 671, Bend, OR 97709 800-285- 3701, 541-382-3921; FAX: 541-388-4667
 Novak's, Inc., 12061 2 30th St., P.O. Box 4045, Parkersburg, WV 26101 304-485-9295; FAX: 304- 428-6722
 Now Products, Inc., 1045 South Edward Drive, Tempe, AZ 85281 602-966-6100; FAX: 602-966-0890
 Nowlin Mfg. Co., Rt. 1, Box 308, Claremore, OK 74017 918-342-0689; FAX: 918-342-0624
 NRI Gunsmith School, 4401 Connecticut Ave. NW, Washington, D.C. 20008
 Nu-Line Guns, Inc., 1053 Caulks Hill Rd., Harvester, MO 63304 314-441-4500, 314-447-4501; FAX: 314-447-5018
 Null Holsters Ltd., K.L., 161 School St. NW, Hill City Station, Resaca, GA 30735 706-625-5643; FAX: 706- 625-9392
 Numrich Arms Corp., 203 Broadway, W. Hurley, NY 12491
 Nu-Teck, 30 Industrial Park Rd., Box 37, Centerbrook, CT 06409 203-767-3573; FAX: 203-767-9137
 NW Sinker and Tackle, 380 Valley Dr., Myrtle Creek, OR 97457-9717
 Nygord Precision Products, P.O. Box 12578, Prescott, AZ 86304 520-717-2315; FAX: 520-717-2198

O

Oakland Custom Arms, Inc., 4690 W. Walton Blvd., Waterford, MI 48329 810-674-8261
 Oakman Turkey Calls, RD 1, Box 825, Harrisonville, PA 17228 717-485-4620
 Oakshore Electronic Sights, Inc., P.O. Box 4470, Ocala, FL 32678-4470 904-629-7112; FAX: 904-629-1433
 Obermeyer Rifled Barrels, 23122 60th St., Bristol, WI 53104 414-843-3537; FAX: 414-843-2129
 October Country, P.O. Box 969, Dept. GD, Hayden, ID 83835 208-772-2068; FAX: 208-772-9230
 Oehler Research, Inc., P.O. Box 9135, Austin, TX 78766 512-327-6900, 800-531-5125; FAX: 512-327- 6903
 Oglesby & Oglesby Gunmakers, Inc., RR 5, Springfield, IL 62707 217-487-7100
 Oil Rod and Gun Shop, 69 Oak St., East Douglas, MA 01516 508-476-3687
 Ojala Holsters, Arvo, P.O. Box 98, N. Hollywood, CA 91603 503-669-1404
 Oker's Engraving, 365 Bell Rd., P.O. Box 126, Shawnee, CO 80475 303-838-6042
 Oklahoma Ammunition Co., 3701A S. Harvard Ave., No. 367, Tulsa, OK 74135-2265 918-396-3187; FAX: 918-396-4270
 Oklahoma Leather Products, Inc., 500 26th NW, Miami, OK 74354 918-542-6651; FAX: 918-542-6653
 OK Weber, Inc., P.O. Box 7485, Eugene, OR 97401 541-747-0458; FAX: 541-747-5927
 Old Wagon Bullets, 32 Old Wagon Rd., Wilton, CT 06897

Old West Bullet Moulds, P.O. Box 519, Flora Vista, NM 87415 505-334-6970
 Old West Reproductions, Inc., R.M. Bachman, 446 Florence S. Loop, Florence, MT 59833 406-273- 2615; FAX: 406-273-2615
 Old Western Scrounger, Inc., 12924 Hwy. A-12, Montague, CA 96064 916-459-5445; FAX: 916-459- 3944
 Old World Gunsmithing, 2901 SE 122nd St., Portland, OR 97236 503-760-7681
 Old World Oil Products, 3827 Queen Ave. N., Minneapolis, MN 55412 612-522-5037
 Ole Frontier Gunsmith Shop, 2617 Hwy. 29 S., Cantonment, FL 32533 904-477-8074
 Olson, Myron, 989 W. Kemp, Watertown, SD 57201 605-886-9787
 Olson, Vic, 5002 Countryside Dr., Imperial, MO 63052 314-296-8086
 Olt Co., Philip S., P.O. Box 550, 12662 Fifth St., Pekin, IL 61554 309-348-3633; FAX: 309-348-3300
 Olympic Optical Co., P.O. Box 752377, Memphis, TN 38175-2377 901-794-3890, 800-238-7120; FAX: 901-794-0676, 800-748-1669
 Omark Industries, Div. of Blount, Inc., 2299 Snake River Ave., P.O. Box 856, Lewiston, ID 83501 800- 627-3640, 208-746-2351
 Omega Sales, P.O. Box 1066, Mt. Clemens, MI 48043 810-469-7323; FAX: 810-469-0425
 One Of A Kind, 15610 Purple Sage, San Antonio, TX 78255 512-695-3364
 Op-Tec, P.O. Box L632, Langhorm, PA 19047 215-757- 5037
 Optical Services Co., P.O. Box 1174, Santa Teresa, NM 88008-1174 505-589-3833
 Orchard Park Enterprise, P.O. Box 563, Orchard Park, NY 14227 616-656-0356
 Ordnance Works, The, 2969 Pidgeon Point Road, Eureka, CA 95501 707-443-3252
 Oregon Arms, Inc. (See Rogue Rifle Co., Inc.)
 Oregon Trail Bullet Company, P.O. Box 529, Dept. P, Baker City, OR 97814 800-811-0548; FAX: 514-523- 1803
 Original Box, Inc., 700 Linden Ave., York, PA 17404 854-2897; FAX: 717-845-4276
 Original Mink Oil, Inc., 10652 NE Holman, Portland, OR 97220 503-255-2814, 800-547-5895; FAX: 503-255-2487
 Orion Rifle Barrel Co., RR2, 137 Cobler Village, Kalispell, MT 59901 406-257-5649
 Or-Un, Tahtakale Menekse Han 18, Istanbul, TURKEY 34460 90212-522-5912; FAX: 90212-522-7973
 Orvis Co., The, Rt. 7, Manchester, VT 05254 802-362- 3622 ext. 283; FAX: 802-362-3525
 Ottmar, Maurice, Box 657, 113 E. Fir, Coulee City, WA 99115 509-632-5717
 Outa-Site Gun Carriers, 219 Market St., Laredo, TX 78040 210-722-4678, 800-880-9715; FAX: 210-726- 4858
 Outdoor Connection, Inc., The, 201 Cotton Dr., P.O. Box 7751, Waco, TX 76714-7751 800-533-6076; 817-772-5575; FAX: 817-776-3553
 Outdoor Edge Cutlery Corp., 2888 Bluff St., Suite 130, Boulder, CO 80301 303-652-8212; FAX: 303-652- 8238
 Outdoor Enthusiast, 3784 W. Woodland, Springfield, MO 65807 417-883-9841
 Outdoor Sports Headquarters, Inc., 967 Watertower Ln., West Carrollton, OH 45449 513-865-5855; FAX: 513-865-5962
 Outdoorsman's Bookstore, The, Llangorse, Brecon, Powys LD3 7UE, U.K. 44-1874-658-660; FAX: 44- 1874-658-650
 Outers Laboratories, Div. of Blount, Inc., Sporting Equipment Div., Route 2,, P.O. Box 39 Onalaska, WI 54650 781-5800; FAX: 608-781-0368
 Ox-Yoke Originals, Inc., 34 Main St., Milo, ME 04463 800-231-8313, 207-943-7351; FAX: 207-943-2416
 Ozark Gun Works, 11830 Cemetery Rd., Rogers, AR 72756 501-631-6944; FAX: 501-631-6944

P

P&M Sales and Service, 5724 Gainsborough Pl., Oak Forest, IL 60452 708-687-7149
 P&S Gun Service, 2138 Old Shepardsville Rd., Louisville, KY 40218 502-456-9346
 Pac-Nor Barreling, 99299 Overlook Rd., P.O. Box 6188, Brookings, OR 97415 503-469-7330; FAX: 503-469-7331
 Pace Marketing, Inc., P.O. Box 2039, Stuart, FL 34995 561-871-9682; FAX: 561-871-6552
 Pachmayr, Ltd., 1875 S. Mountain Ave., Monrovia, CA 91016 818-357-7771, 800-423-9704; FAX: 818-358- 7251
 Pacific Cartridge, Inc., 2425 Salashan Loop Road, Fendale, WA 98248 360-366-4444; FAX: 360-366- 4445
 Pacific Pistolcraft, 1810 E. Columbia Ave., Tacoma, WA 98404 206-474-5465
 Pacific Precision, 755 Antelope Rd., P.O. Box 2549, White City, OR 97503 503-826-5808; FAX: 503-826- 5304
 Rimrock Rifle Stocks, P.O. Box 589, Vashon Island, WA 98070 206-463-5551; FAX: 206-463-2526
 Pacific Research Laboratories, Inc. (See Rimrock Rifle Stocks)
 Pacific Rifle Co., 1040-D Industrial Parkway, Newberg, OR 97132 503-538-7437
 Paco's (See Small Custom Mould & Bullet Co.)
 P.A.C.T., Inc., P.O. Box 531525, Grand Prairie, TX 75053 214-641-0049

Page Custom Bullets, P.O. Box 25, Port Moresby Papua, NEW GUINEA
 Pagel Gun Works, Inc., 1407 4th St. NW, Grand Rapids, MN 55744 218-326-3003
 Paintball Games International Magazine (Aceville Publications), Castle House, 97 High St. Colchester, Essex, CO 1 1TH ENGLAND 011-44-206-564840
 Paintball Sports Magazine, 540 Main St., Mt. Kisco, NY 10549 914-241-7400
 Palmer Manufacturing Co., Inc., C., P.O. Box 220, West Newton, PA 15089 412-872-8200; FAX: 412-872- 8302
 Palmer Security Products, 2930 N. Campbell Ave., Chicago, IL 60618 800-788-7725; FAX: 773-267- 8080
 Paisa Outdoor Products, P.O. Box 81336, Lincoln, NE 68501 402-488-5288, 800-456-9281; FAX: 402-488- 2321
 PanaVise Products, Inc., 7540 Colbert Drive, Sparks, NV 89431 702-850-2900; FAX: 702-850-2929
 Para-Ordnance Mfg., Inc., 980 Tapscott Rd., Scarborough, Ont. MIX 1E7, CANADA 416-297- 7855; FAX: 416-297-1289 (U.S. importer—Para- Ordnance, Inc.)
 Para-Ordnance, Inc., 1919 NE 45th St., Ft. Lauderdale, FL 33308
 Paragon Sales & Services, Inc., P.O. Box 2022, Joliet, IL 60434 815-725-9212; FAX: 815-725-8974
 Pardini Armi Sri, Via Italica 154, 55043 Lido Di Camaio Lu, ITALY 584-90121; FAX: 584-90122 (U.S. importers—Nygord Precision Products;MCS, Inc.)
 Paris, Frank J., 17417 Pershing St., Livonia, MI 48152- 3822
 Park Rifle Co., Ltd., The, Unit 6a, Dartford Trade Park, Power Mill Lane, Dartford, Kent, ENGLAND DA7 7NX 011-0322-222512
 Parker Div. Reageant Chemical (See Parker Reproductions)
 Parker Gun Finishes, 9337 Smokey Row Rd., Strawberry Plains, TN 37871 423-933-3286
 Parker Reproductions, 124 River Rd., Middlesex, NJ 08846 908-469-0100; FAX: 908-469-9692
 Parker, Mark D., 1240 Florida Ave. 7, Longmont, CO 80501 303-772-0214
 Parsons Optical Mfg. Co., P.O. Box 192, Ross, OH 45061 513-867-0820; FAX: 513-867-8380
 Parts & Surplus, P.O. Box 22074, Memphis, TN 38122 901-683-4007
 Partridge Sales Ltd., John, Trent Meadows, Rugeley, Staffordshire, WS15 2HS ENGLAND 0889-584438
 Pasadena Gun Center, 206 E. Shaw, Pasadena, TX 77506 713-472-0417; FAX: 713-472-1322
 Passive Bullet Traps, Inc. (See Savage Range Systems, Inc.)
 PAST Sporting Goods, Inc., P.O. Box 1035, Columbia, MO 65205 314-445-9200; FAX: 314-446-6606
 Paterson Gunsmithing, 438 Main St., Paterson, NJ 07502 201-345-4100
 Pathfinder Sports Leather, 2920 E. Chambers St., Phoenix, AZ 85040 602-276-0016
 Patrick Bullets, P.O. Box 172, Warwick QSLD 4370 AUSTRALIA
 Pattern Control, 114 N. Third St., P.O. Box 462105, Garland, TX 75046 214-494-3551; FAX: 214-272- 8447
 Paul Co., The, 27385 Pressonville Rd., Wellsville, KS 66092 913-883-4444; FAX: 913-883-2525
 Paulsen Gunstocks, Rt. 71, Box 11, Chinook, MT 59523 406-357-3403
 Payne Photography, Robert, P.O. Box 141471, Austin, TX 78714 512-272-4554
 PC Bullet ADC, Inc., 52700 NE First, Scappoose, OR 97056-3212 503-543-5088; FAX: 503-543-5990
 PC Co., 5942 Secor Rd., Toledo, OH 43623 419-472- 6222
 Peacemaker Specialists, P.O. Box 157, Whitmore, CA 96096 916-472-3438
 Pearce Grip, Inc., P.O. Box 187, Bothell, WA 98041- 0187 206-485-5488; FAX:206-488-9497
 Pease Accuracy, Bob, P.O. Box 310787, New Braunfels, TX 78131 210-625-1342
 PECAR Herbert Schwarz, GmbH, Kreuzbergstrasse 6, 10965 Berlin, GERMANY 004930-785-7383; FAX: 004930-785-1934
 Pecatonica River Longrifle, 5205 Nottingham Dr., Rockford, IL 61111 815-968-1995; FAX: 815-968- 1996
 Pedersen, C.R., 2717 S. Pere Marquette Hwy., Ludington, MI 49431 616-843-2061
 Pedersen, Rex C., 2717 S. Pere Marquette Hwy., Ludington, MI 49431 616-843-2061
 Pedersoli and Co., Davide, Via Artigiani 57, Gardone V.T., Brescia, ITALY 25063 030-8912402; FAX: 030-8911019 (U.S. importers—Beauchamp & Son, Inc.; Cabela's; Cape Outfitters; Cimarron Arms; Dixie Gun Works; EMF Co., Inc.; Navy Arms Co.; Track of the Wolf, Inc.)
 Peerless Alloy, Inc., 1445 Osage St., Denver, CO 80204-2439 303-825-6394, 800-253-1278
 Peet Shoe Dryer, Inc., 130 S. 5th St., P.O. Box 618, St. Maries, ID 83861 208-245-2095, 800-222-PEET; FAX: 208-245-5441
 Peifer Rifle Co., P.O. Box 192, Nokomis, IL 62075- 0192 217-563-7050; FAX: 217-563-7060
 Pejisa Ballistics, 2120 Kenwood Pkwy., Minneapolis, MN 55405 612-374-3337; FAX: 612-374-3337
 Pelaire Products, 5346 Bonky Ct., W. Palm Beach, FL 33415 561-439-0691; FAX: 561-967-0052
 Pell, John T. (See KOGOT)
 Peltor, Inc. (See Aero Peltor)

PEM's Mfg. Co., 5063 Waterloo Rd., Atwater, OH 44201 216-947-3721
 Pence Precision Barrels, 7567 E. 900 S., S. Whitley, IN 46787 219-839-4745
 Pend Oreille Sport Shop, 3100 Hwy. 200 East, Sandpoint, ID 83864 208-263-2412
 Pendleton Royal, c o Swingler Buckland Ltd., 4 7 Highgate St., Birmingham, ENGLAND B12 0XS 44 121 440 3060,44 121 446 5898; FAX: 44 121 446 4165
 Pendleton Woolen Mills, P.O. Box 3030, 220 N.W. Broadway, Portland, OR 97208 503-226-4801
 Penguin Industries, Inc., Airport Industrial Mall, Coatesville, PA 19320 610-384-6000; FAX: 610-857- 5980
 Penn Bullets, P.O. Box 756, Indianola, PA 15051
 Penn's Woods Products, Inc., 19 W. Pittsburgh St., Delmont, PA 15626 412-468-8311; FAX: 412-468- 8975
 Pennsylvania Gun Parts, 1701 Mud Run Rd., York Springs, PA 17372 717-259-8010; FAX: 717-259- 0057
 Pennsylvania Gunsmith School, 812 Ohio River Blvd., Avalon, Pittsburgh, PA 15202 412-766-1812
 Penrod Precision, 312 College Ave., P.O. Box 307, N. Manchester, IN 46962 219-982-8385
 Pentax Corp., 35 Inverness Dr. E., Englewood, CO 80112 800-709-2020; FAX: 303-643-0393
 Pentheny de Pentheny, 2352 Baggett Ct., Santa Rosa, CA 95401 707-573-1390; FAX: 707-573-1390
 Perazone-Gunsmith, Brian, Cold Spring Rd., Roxbury, NY 12474 607-326-4088; FAX: 607-326-3140
 Perazzi m.a.p. S.p.A. (See Armi Perazzi S.p.A.)
 Perazzi USA, Inc., 1207 S. Shamrock Ave., Monrovia, CA 91016 818-303-0068; FAX: 818-303-2081
 Peregrine Sporting Arms, Inc., 14155 Brighton Rd., Brighton, CO 80601 303-654-0850
 Performance Specialists, 308 Eanes School Rd., Austin, TX 78746 512-327-0119
 Peripheral Data Systems (See Arms Software)
 Personal Protection Systems, RD 5, Box 5027-A, Moscow, PA 18444 717-842-1766
 Perugini Visini & Co. S.r.l., Via Camprelle, 126,25080 Nuvolera (Bs.), ITALY
 Peters Stahl GmbH, Stettiner Strasse 42, D-33106 Paderborn, GERMANY 05251-750025; FAX: 05251- 75611 (U.S. importer—Franzen International, Inc.)
 Petersen Publishing Co., 6420 Wilshire Blvd., Los Angeles, CA 90048 213-782-2000; FAX: 213-782- 2867
 Peterson Gun Shop, Inc., A.W., 4255 W. Old U.S. 441, Mt. Dora, FL 32757-3299 352-383-4258; FAX: 352- 735-1001
 Petro-Explo, Inc., 7650 U.S. Hwy. 287, Suite 100, Arlington, TX 76017 817-478-8888
 Pettinger Books, Gerald, Rt. 2, Box 125, Russell, IA 50238 515-535-2239
 Pflumm Mfg. Co., 10662 Widmer Rd., Lenexa, KS 66215 800-888-4867; FAX: 913-451-7857
 PFRB Co., P.O. Box 1242, Bloomington, IL 61702 473-3964; FAX: 309-473-2161
 Phil-Chem, Inc. (See George & Roy's)
 Phillippi Custom Bullets, Justin, P.O. Box 773, Ligonier, PA 15658 412-238-9671
 Phillips, Jerry, P.O. Box L632, Langhome, PA 19047 215-757-5037
 Phillips & Rodgers, Inc., 100 Hilbig, Suite C, Conroe, TX 77301 409-756-1001, 800-682-2247; FAX: 409- 756-0976
 Phoenix Arms, 1420 S. Archibald Ave., Ontario, CA 91761 909-947-4843; FAX: 909-947-6798
 Photronic Systems Engineering Company, 6731 Via De La Reina, Bonsall, CA 92003 619-758-8000
 Piedmont Community College, P.O. Box 1197, Roxboro, NC 27573 910-599-1181
 Pierce Pistols, 55 Sorrellwood Lane, Sharpsburg, GA 30277-9523 404-253-8192
 Pietta (See U.S. importers—Navy Arms Co.; Taylor's & Co., Inc.)
 Pilgrim Pewter, Inc. (See Bell Originals Inc., Sid)
 Pilkington, Scott, Little Trees Ramble, P.O. Box 97, Monteagle, TN 37356 615-924-3475; FAX: 615-924- 3489
 Pine Technical College, 1100 4th St., Pine City, MN 55063 800-521-7463; FAX: 612-629-6766
 Pinetree Bullets, 133 Skeena St., Kitimat BC, CANADA V8C 1Z1 604-632-3768; FAX: 604-632- 3768
 Pioneer Arms Co., 355 Lawrence Rd., Broomall, PA 19008 215-356-5203
 Pioneer Guns, 5228 Montgomery Rd., Norwood, OH 45212 513-631-4871
 Pioneer Research, Inc., 216 Haddon Ave., Suite 102, Westmont, NJ 08108 800-257-7742; FAX: 609-858- 8695
 Piotti (See U.S. importer—Moore & Co., Wm. Larkin) Piquette, Paul R., 80 Bradford Dr., Feeding Hills, MA 01030 413-781-8300, Ext. 682
 Plaxco, J. Michael, Rt. 1, P.O. Box 203, Roland, AR 72135 501-868-9787
 Plaza Cutlery, Inc., 3333 Bristol, 161, South Coast Plaza, Costa Mesa, CA 92626 714-549-3932
 Plum City Ballistic Range, N2162 80th St., Plum City, WI 54761-8622 715-647-2539
 PlumFire Press, Inc., 30-A Grove Ave., Patchogue, NY 11772-4112 800-695-7246; FAX: 516-758-4071
 PMC Eldorado Cartridge Corp., P.O. Box 62508, 12801 U.S. Hwy. 95 S., Boulder City, NV 89005 702- 294-0025; FAX: 702-294-0121
 P.M. Enterprises, Inc., 146 Curtis Hill Rd., Chehalis, WA 98532 360-748-3743; FAX: 360-748-1802

Poburka, Philip (See Bison Studios)

Pohl, Henry A. (See Great American Gun Co.)

Pointing Dog Journal, Village Press Publications, P.O. Box 968, Dept. PGD, Traverse City, MI 49685 800- 272-3246; FAX: 616-946-3289

Police Bookshelf, P.O. Box 122, Concord, NH 03301 224-6814; FAX: 603-226-3554

Poly wad, Inc., P.O. Box 7916, Macon, GA 31209 912- 477-0669

Pomeroy, Robert, RR 1, Box 50, E. Corinth, ME 04427 285-7721

Ponsness Warren, P.O. Box 8, Rathdrum, ID 83858 687-2231; FAX: 208-687-2233

Pony Express Reloaders, 608 E. Co. Rd. D, Suite 3, St. Paul, MN 55117 612-483-9406; FAX: 612-483-9884

Pony Express Sport Shop, Inc., 16606 Schoenbom St., North Hills, CA 91343 818-895-1231

Porta Blind, Inc., 2700 Speedway, Wichita Falls, TX 76308 817-723-6620

Portus, Robert, 130 Ferry Rd., Grants Pass, OR 97526 503-476-4919

Potts, Wayne E., 912 Poplar St., Denver, CO 80220 303-355-5462

Powder Horn Antiques, P.O. Box 4196, Ft. Lauderdale, FL 33338 305-565-6060

Powder Horn, Inc., The, P.O. Box 114 Patty Drive, Cusseta, GA 31805 404-989-3257

Powell & Son (Gunmakers) Ltd., William, 35-37 Carrs Lane, Birmingham B4 7SX ENGLAND 121-643- 0689; FAX: 121-631-3504
(U.S. importer—The William Powell Agency)

Powell Agency, William, The, 22 Circle Dr., Bellmore, NY 11710 516-679-1158

Power Custom, Inc., RR 2, P.O. Box 756AB, Gravois Mills, MO 65037 314-372-5684

Powley Computer (See Hutton Rifle Ranch)

Practical Tools, Inc., Div. Behlert Precision, 7067 Easton Rd., P.O. Box 133, Pipersville, PA 18947 215-7301; FAX: 215-766-8681

Pragotrade, 307 Humberline Dr., Rexdale, Ontario, CANADA M9W 5V1 416-675-1322

Prairie River Arms, 1220 N. Sixth St., Princeton, IL 61356 815-875-1616, 800-445-1541; FAX: 815-875- 1402

Pranger, Ed G., 1414 7th St., Anacortes, WA 98221 206-293-3488

Precise International, 15 Corporate Dr., Orangeburg, NY 10962 914-365-3500; FAX: 914-425-4700

Precise Metalsmithing Enterprises, 146 Curtis Hill Rd., Chehalis, WA 98532 206-748-3743; FAX: 206-748- 8102

Precision Airgun Sales, Inc., 5139 Warrensville Center Rd., Maple Hts., OH 44137-1906 216-587-5005

Precision Cartridge, 176 Eastside Rd., Deer Lodge, MT 59722 800-397-3901, 406-846-3900

Precision Cast Bullets, 101 Mud Creek Lane, Ronan, MT 59864 406-676-5135

Precision Castings & Equipment, Inc., P.O. Box 326, Jasper, IN 47547-0135 812-634-9167

Precision Components, 3177 Sunrise Lake, Milford, PA 18337 717-686-4414

Precision Components and Guns, Rt. 55, P.O. Box 337, Pawling, NY 12564 914-855-3040

Precision Delta Corp., P.O. Box 128, Ruleville, MS 38771 601-756-2810; FAX: 601-756-2590

Precision Metal Finishing, John Westrom, P.O. Box 3186, Des Moines, IA 50316 515-288-8680; FAX: 515-244-3925

Precision Munitions, Inc., P.O. Box 326, Jasper, IN 47547

Precision Reloading, Inc., P.O. Box 122, Stafford Springs, CT 06076 860-684-7979; FAX: 860-684- 6788

Precision Sales International, Inc., P.O. Box 1776, Westfield, MA 01086 413-562-5055; FAX: 413-562- 5056

Precision Shooting, Inc., 222 McKee St., Manchester, CT 06040 860-645-8776; FAX: 860-643-8215

Precision Small Arms, 9777 Wilshire Blvd., Suite 1005, Beverly Hills, CA 90212 310-859-4867; FAX: 310-859-2868

Precision Specialties, 131 Hendon Dr., Feeding Hills, MA 01030 413-786-3365; FAX: 413-786-3365

Precision Sport Optics, 15571 Producer Lane, Unit G, Huntington Beach, CA 92649 714-891-1309; FAX: 714-892-6920

Premier Reticles, 920 Breckinridge Lane, Winchester, VA 22601-6707 540-722-0601; FAX: 540-722-3522

Prescott Projectile Co., 1808 Meadowbrook Road, Prescott, AZ 86303

Preslik's Gunstocks, 4245 Keith Ln., Chico, CA 95926 916-891-8236

Pre-Winchester 92-90-62 Parts Co., P.O. Box 8125, W. Palm Beach, FL 33407

Price Bullets, Patrick W., 16520 Worthley Drive, San Lorenzo, CA 94580 510-278-1547

Prime Reloading, 30 Chiswick End, Meldreth, Royston SG8 6LZ UK 0763-260636

Primos, Inc., P.O. Box 12785, Jackson, MS 39236-2785 366-1288; FAX: 601-362-3274

PRL Bullets, c o Blackburn Enterprises, 114 Stuart Rd., Ste. 110, Cleveland, TN 37312 423-559-0340

Pro Load Ammunition, Inc., 5180 E. Seltice Way, Post Falls, ID 83854 208-773-9444; FAX: 208-773-9441

Pro-Mark, Div. of Wells Lamont, 6640 W. Touhy, Chicago, IL 60648 312-647-8200

Pro-Port Ltd., 41302 Executive Dr., Harrison Twp., MI 48045-1306 810-469-7323; FAX: 810-469-0425

Pro-Shot Products, Inc., P.O. Box 763, Taylorville, IL 62568 217-824-9133; FAX: 217-824-8861

Professional Firearms Record Book Co. (See PFRB Co.)

Professional Gunsmiths of America, Inc., Route 1, Box 224F, Lexington, MO 64067 816-259-2636

Professional Hunter Supplies (See Star Custom Bullets)

Professional Ordnance, Inc., 1215 E. Airport Dr., Box 182, Ontario, CA 91761 909-923-5559; FAX: 909- 923-0899

ProlixE Lubricants, P.O. Box 1348, Victorville, CA 92393 800-248-LUBE, 619-243-3129; FAX: 619- 241-0148

Protecto Plastics, Div. of Penguin Ind., Airport Industrial Mall, Coatesville, PA 19320 215-384-6000

Protector Mfg. Co., Inc., The, 443 Ashwood Place, Boca Raton, FL 33431 407-394-6011

Protektor Model, 1-11 Bridge St., Galeton, PA 16922 814-435-2442

Prototech Industries, Inc., Rt. 1, Box 81, Delia, KS 66418 913-771-3571; FAX: 913-771-2531

ProWare, Inc., 15847 NE Hancock St., Portland, OR 97230 503-239-0159

P.S.M.G. Gun Co., 10 Park Ave., Arlington, MA 02174 646-8845; FAX: 617-646-2133

PWL Gunleather, P.O. Box 450432, Atlanta, GA 31145 770-822-1640; FAX: 770-822-1704

Pyramid, Inc., 3292 S. Highway 97, Redmond, OR 97756 503-548-1041; FAX: 503-923-1004

Q

Quack Decoy & Sporting Clays, 4 Ann & Hope Way, P.O. Box 98, Cumberland, RI 02864 401-723-8202; FAX: 401-722-5910

Quaker Boy, Inc., 5455 Webster Rd., Orchard Parks, NY 14127 716-662-3979; FAX: 716-662-9426

Quality Arms, Inc., Box 19477, Dept. GD, Houston, TX 77224 713-870-8377; FAX: 713-870-8524

Quality Firearms of Idaho, Inc., 659 Harmon Way, Middleton, ID 83644-3065 208-466-1631

Quality Parts Co. Bushmaster Firearms, 999 Roosevelt Trail, Bldg. 3, Windham, ME 04062 800-998-7928, 892-2005; FAX: 207-892-8068

Quarton USA, Ltd. Co., 7042 Alamo Downs Pkwy., Suite 370, San Antonio, TX 78238-4518 800-520- 8435, 210-520-8430; FAX: 210-520-8433

Que Industries, Inc., P.O. Box 2471, Everett, WA 98203 800-769-6930, 206-347-9843; FAX: 206-514-3266

Queen Cutlery Co., P.O. Box 500, Franklinville, NY 14737 800-222-5233; FAX: 716-676-5535

Quigley's Personal Protection Strategies, Paxton, 9903 Santa Monica Blvd., 300 Beverly Hills, CA 90212 310-281-1762

R

R&C Knives & Such, P.O. Box 1047, Manteca, CA 95336 209-239-3722; FAX: 209-825-6947

R&J Gun Shop, 133 W. Main St., John Day, OR 97845 503-575-2130

R&S Industries Corp., 8255 Brentwood Industrial Dr., St. Louis, MO 63144 314-781-5400

Rabeno, Martin, 92 Spook Hole Rd., Ellenville, NY 12428 914-647-4567

Radack Photography, Lauren, 21140 Jib Court L-12, Aventura, FL 33180 305-931-3110

Radiator Specialty Co., 1900 Wilkinson Blvd., P.O.

Box 34689, Charlotte, NC 28234 800-438-6947; FAX: 800-421-9525

Radical Concepts, P.O. Box 1473, Lake Grove, OR 97035 503-538-7437

Rainier Ballistics Corp., 4500 15th St. East, Tacoma, WA 98424 800-638-8722, 206-922-7589; FAX: 206-922-7854

Ram-Line Blount, Inc., P.O. Box 39, Onalaska, WI 54650-0039

Rampart International, 2781 W. Mac Arthur Blvd., #B- 283, Santa Ana, CA 92704 800-976-7240, 714-557- 6405

Ranch Products, P.O. Box 145, Malinta, OH 43535 313-277-3118; FAX: 313-565-8536

Randall-Made Knives, P.O. Box 1988, Orlando, FL 32802 407-855-8075

Randco UK, 286 Gipsy Rd., Welling, Kent DA 16 1JJ, ENGLAND 44 81 303 4118

Randolph Engineering, Inc., 26 Thomas Patten Dr., Randolph, MA 02368 800-541-1405; FAX: 800-875- 4200

Range Brass Products Company, P.O. Box 218, Rockport, TX 78381

Ranger Mfg. Co., Inc., 1536 Crescent Dr., P.O. Box 14069, Augusta, GA 30919-0069 706-738-2023; FAX: 404-738-3608

Ranger Products, 2623 Grand Blvd., Suite 209, Holiday, FL 34609 813-942-4652, 800-407-7007; FAX: 813-942-6221

Ranger Shooting Glasses, 26 Thomas Patten Dr., Randolph, MA 02368 800-541-1405; FAX: 617-986- 0337

Ranging, Inc., Routes 5 & 20, East Bloomfield, NY 14443 716-657-6161; FAX: 716-657-5405

Ransom International Corp., P.O. Box 3845, 1040-A Sandretto Dr., Prescott, AZ 86302 520-778-7899; FAX: 520-778-7993;

E-MAIL: ransom@primenet.com; WEB: <http://www.primenet.com> bransom

Rapine Bullet Mould Mfg. Co., 9503 Landis Lane, East Greenville, PA 18041 215-679-5413; FAX: 215-679- 9795

Raptor Arms Co., Inc., 115 S. Union St., Suite 308, Alexandria, VA 22314 703-683-0018; FAX: 703- 683-5592

Rattlers Brand, P.O. Box 311, 115 E. Main St., Thomaston, GA 30286 706-647-7131, 800-825-7131; FAX: 706-646-5090

Ravell Ltd., 289 Diputacion St., 08009, Barcelona SPAIN 34(3) 4874486; FAX: 34(3) 4881394
 Ray's Gunsmith Shop, 3199 Elm Ave., Grand Junction, CO 81504 970-434-6162; FAX: 970-434-6162
 Raytech, Div. of Lyman Products Corp., 475 Smith Street, Middletown, CT 06457-1541 860-632-2020; FAX: 860-632-1699
 RCBS, Div. of Blount, Inc., Sporting Equipment Div., 605 Oro Dam Blvd., Oroville, CA 95965 800-533- 5000, 916-533-5191; FAX: 916-533-1647
 Reagent Chemical & Research, Inc. (See Calico Hardwoods, Inc.)
 Reardon Products, P.O. Box 126, Morrison, IL 61270 815-772-3155
 Recoilless Technologies, Inc., 3432 W. Wilshire Dr., Suite 11, Phoenix, AZ 85009 602-278-8903; FAX: 602-272-5946
 Red Ball, 100 Factory St., Nashua, NH 03060 603-881- 4420
 Red Cedar Precision Mfg., W. 485 Spruce Dr., Brodhead, WI 53520 608-897-8416
 Red Diamond Dist. Co., 1304 Snowdon Dr., Knoxville, TN 37912
 Redding Reloading Equipment, 1089 Starr Rd., Cortland, NY 13045 607-753-3331; FAX: 607-756- 8445
 Redfield, Inc., 5800 E. Jewell Ave., Denver, CO 80224 303-757-6411; FAX: 303-756-2338
 Redman's Rifling & Reboring, 189 Nichols Rd., Omak, WA 98841 509-826-5512
 Redwood Bullet Works, 3559 Bay Rd., Redwood City, CA 94063 415-367-6741
 Reed, Dave, Rt. 1, Box 374, Minnesota City, MN 55959 507-689-2944
 Refrigiwear, Inc., 71 Inip Dr., Inwood, Long Island, NY 11696
 R.E.L., P.O. Box 88, Tallevast, FL 34270 813-755-0085
 Reiswig, Wallace E. (See Claro Walnut Gunstock Co.)
 Reloaders Equipment Co., 4680 High St., Ecorse, MI 48229
 Reloading Specialties, Inc., Box 1130, Pine Island, MN 55463 507-356-8500; FAX: 507-356-8800
 Remington Arms Co., Inc., 870 Remington Drive, P.O. Box 700, Madison, NC 27025-0700 800-243-9700; 910-548-8700
 Remington Double Shotguns, 7885 Cyd Dr., Denver, CO 80221 303-429-6947
 Renegade, P.O. Box 31546, Phoenix, AZ 85046 602- 482-6777; FAX: 602-482-1952
 Renfrew Guns & Supplies, R.R. 4, Renfrew, Ontario K7V3Z7 CANADA 613-432-7080
 Reno, Wayne, 2808 Stagestop Rd., Jefferson, CO 80456 719-836-3452
 Republic Arms, Inc., 15167 Sierra Bonita Lane, Chino, CA 91710 909-597-3873; FAX: 909-393-9771
 R.E.T. Enterprises, 2608 S. Chestnut, Broken Arrow, OK 74012 918-251-GUNS; FAX: 918-251-0587
 Retting, Inc., Martin B., 11029 Washington, Culver City, CA 90232 213-837-2412
 R.F.D. Rifles, 8230 Wilson Dr., Ralston, NE 68127 402-331-9529
 R.G.-G., Inc., P.O. Box 1261, Conifer, CO 80433-1261 303-697-4154; FAX: 303-697-4154
 Rhino, P.O. Box 787, Locust, NC 28097 704-753-2198
 Rhodeside, Inc., 1704 Commerce Dr., Piqua, OH 45356 513-773-5781
 Rice, Keith (See White Rock Tool & Die)
 Richards, John, Richards Classic Oil Finish, Rt. 2, Box 325, Bedford, KY 40006 502-255-7222
 Richards Micro-Fit Stocks, 8331 N. San Fernando Ave., Sun Valley, CA 91352 818-767-6097; FAX: 818-767- 7121
 Rickard, Inc., Pete, RD 1, Box 292, Cobleskill, NY 12043 800-282-5663; FAX: 518-234-2454
 Ridgetop Sporting Goods, P.O. Box 306, 42907 Hilligoss Ln. East, Eatonville, WA 98328 360-832- 6422; FAX: 360-832-6422
 Riebe Co., W.J., 3434 Tucker Rd., Boise, ID 83703
 Ries, Chuck, 415 Ridgecrest Dr., Grants Pass, OR 97527 503-476-5623
 Rifle Works & Armory, 707 12th St., Cody, WY 82414 307-587-4919
 Rifles Inc., 873 W. 5400 N., Cedar City, UT 84720 801-5996; FAX: 801-586-5996
 RIG Products, 87 Coney Island Dr., Sparks, NV 89431- 6334 702-331-5666; FAX: 702-331-5669
 Rigby & Co., John, 66 Great Suffolk St., London SE1 OBU, ENGLAND 0171-620-0690; FAX: 0171-928- 9205
 Riggs, Jim, 206 Azalea, Boeme, TX 78006 210-249- 8567
 Riling Arms Books Co., Ray, 6844 Gorsten St., P.O. Box 18925, Philadelphia, PA 19119 215-438-2456; FAX: 215-438-5395
 Rim Pac Sports, Inc., 1034 N. Soldano Ave., Azusa, CA 91702-2135
 Ringler Custom Leather Co., 31 Shining Mtn. Rd., Powell, WY 82435 307-645-3255
 Ripley Rifles, 42 Fletcher Street, Ripley, Derbyshire, DE5 3LP ENGLAND 011-0773-748353
 R.I.S. Co., Inc., 718 Timberlake Circle, Richardson, TX 75080 214-235-0933
 River Road Sporting Clays, Bruce Barsotti, P.O. Box 3016, Gonzales, CA 93926 408-675-2473
 Rizzini, Battista, Via 2 Giugno, 7 7Bis-25060 Marcheno (Brescia), ITALY (U.S. importers—Wm. Larkin Moore & Co.; New England Arms Co.) Rizzini F.lli (See U.S. importers—Moore & Co., Wm. Larkin; New England Arms Co.)
 RLCM Enterprises, 110 Hill Crest Drive, Burleson, TX 76028

R.M. Precision, Inc., Attn. Greg F. Smith Marketing, P.O. Box 210, La Verkin, UT 84745 801-635-4656; FAX: 801-635-4430
 RMS Custom Gunsmithing, 4120 N. Bitterwell, Prescott Valley, AZ 86314 520-772-7626
 Robar Co.'s, Inc., The, 21438 N. 7th Ave., Suite B, Phoenix, AZ 85027 602-581-2648; FAX: 602-582- 0059
 Roberts Engraver, J.J., 7808 Lake Dr., Manassas, VA 22111 703-330-0448
 Roberts Products, 25328 SE Iss. Beaver Lk. Rd., Issaquah, WA 98029 206-392-8172
 Robinett, R.G., P.O. Box 72, Madrid, IA 50156 515- 795-2906
 Robinson, Don, Pennsylvania Hse., 36 Fairfax Crescent, Southowram, Halifax, W. Yorkshire HX3 9SQ, ENGLAND 0422-364458
 Robinson Firearms Mfg. Ltd., 1699 Blondeaux Crescent, Kelowna, B.C. CANADA VIY 4J8 604- 868-9596
 Robinson H.V. Bullets, 3145 Church St., Zachary, LA 70791 504-654-4029
 Rochester Lead Works, 76 Anderson Ave., Rochester, NY 14607 716-442-8500; FAX: 716-442-4712
 Rockwood Corp., Speedwell Division, 136 Lincoln Blvd., Middlesex, NJ 08846 908-560-7171, 800-243- 8274; FAX: 980-560-7475
 Rocky Fork Enterprises, P.O. Box 427, 878 Battle Rd., Nolensville, TN 37135 615-941 -1307
 Rocky Mountain Arms, Inc., 600 S. Sunset, Unit C, Longmont, CO 80501 303-768-8522; FAX: 303-678- 8766
 Rocky Mountain High Sports Glasses, 8121 N. Central Park Ave., Skokie, IL 60076 847-679-1012, 800-323- 1418; FAX: 847-679-0184
 Rocky Mountain Rifle Works Ltd., 1707 14th St., Boulder, CO 80302 303-443-9189
 Rocky Mountain Target Co., 3 Aloe Way, Leesburg, FL 34788 352-365-9598
 Rocky Mountain Wildlife Products, P.O. Box 999, La Porte, CO 80535 970-484-2768; FAX: 970-484-0807
 Rocky Shoes & Boots, 294 Harper St., Nelsonville, OH 45764 800-848-9452, 614-753-1951; FAX: 614-753- 4024
 Rod Guide Co., Box 1149, Forsyth, MO 65653 800- 952-2774
 Rodgers & Sons Ltd., Joseph (See George Ibberson (Sheffield) Ltd.)
 Rogers Gunsmithing, Bob, P.O. Box 305,344 S. Walnut St., Franklin Grove, IL 61031 815-456-2685; FAX: 815-288-7142
 Rogue Rifle Co., Inc., P.O. Box 20, Prospect, OR 97536 560-4040; FAX: 541-560-4041
 Rogue River Rifleworks, 1317 Spring St., Paso Robles, CA 93446 805-227-4706; FAX: 805-227-4723
 Rohner, Hans, 1148 Twin Sisters Ranch Rd., Nederland, CO 80466-9600
 Rohner, John, 710 Sunshine Canyon, Boulder, CO 303-444-3841
 Rolston, Fred W., Inc., 210 E. Cummins St., Tecumseh, MI 49286 517-423-6002,800-314-9061 (orders only); FAX: 517-423-6002
 Romain's Custom Guns, Inc., RD 1, Whetstone Rd., Brockport, PA 15823 814-265-1948
 Rooster Laboratories, P.O. Box 412514, Kansas City, MO 64141 816-474-1622; FAX: 816-474-1307
 Rorschach Precision Products, P.O. Box 151613, Irving, TX 75015 214-790-3487
 Rosenberg & Sons, Jack A., 12229 Cox Ln., Dallas, TX 214-241-6302
 Rosenthal, Brad and Sallie, 19303 Ossenfort Ct., St. Louis, MO 63038 314-273-5159; FAX: 314-273- 5149
 Ross & Webb (See Ross, Don)
 Ross, Don, 12813 West 83 Terrace, Lenexa, KS 66215 913-492-6982
 Rosser, Bob, 1824 29th Ave., Suite 214, Birmingham, AL 35209 205-870-4422; FAX: 205-870-4421
 Rossi S.A., Amadeo, Rua: Amadeo Rossi, 143, Sao Leopoldo, RS. BRAZIL 93030-220 051-592-5566 (U.S. importer—Interarms)
 Roto Carve, 2754 Garden Ave., Janesville, IA 50647
 Round Edge, Inc., P.O. Box 723, Lansdale, PA 19446 215-361-0859
 Rowe Engineering, Inc. (See R.E.I.)
 Royal Arms Gunstocks, 919 8th Ave. NW, Great Falls, MT 59404 406-453-1149
 Roy's Custom Grips, Rt. 3, Box 174-E, Lynchburg, VA 24504 804-993-3470
 RPM, 15481 N. Twin Lakes Dr., Tucson, AZ 85739 520-825-1233; FAX: 520-825-3333
 Rubright Bullets, 1008 S. Quince Rd., Walnutport, PA 18088 215-767-1339
 Rucker Dist. Inc., P.O. Box 479, Terrell, TX 75160 214-563-2094
 Rudnicki, Susan, 9 Water St., Arcade, NY 14009 716- 492-2450
 Ruger (See Sturm, Ruger & Co., Inc.)
 Rundell's Gun Shop, 6198 Frances Rd., Clio, MI 48420 313-687-0559
 Robert P. Runge, 94 Grove St., Ilion, NY 13357 315- 894-3036
 Rupert's Gun Shop, 2202 Dick Rd., Suite B, Fenwick, MI 48834 517-248-3252
 Russ Trading Post, 23 William St., Addison, NY 14801- 1326 607-359-3896
 Russell Knives, Inc., A.G., 1705 Hwy. 71B North, Springdale, AR 72764 501-751-7341
 Rusteprufe Laboratories, 1319 Jefferson Ave., Sparta, WI 54656 608-269-4144
 Rusty Duck Premium Gun Care Products, 7785 Foundation Dr., Suite 6, Florence, KY 41042 606- 342-5553; FAX: 606-342-5556

Rutgers Book Center, 127 Raritan Ave., Highland Park, NJ 08904 908-545-4344; FAX: 908-545-6686
 Rutten (See U.S. importer—Labanu, Inc.)
 Ruvel & Co., Inc., 4128-30 W. Belmont Ave., Chicago, IL 60641 773-286-9494; FAX: 773-286-9323
 R.V.I. (See Fire'n Five)
 RWS (See U.S. importer—Dynamit Nobel-RWS, Inc.)
 Ryan, Chad L., RR 3, Box 72, Cresco, IA 52136 319- 547-4384
 Rybka Custom Leather Equipment, Thad, 134 Havilah Hill, Odenville, AL 35120

S

S&B Industries, 11238 McKinley Rd., Montrose, MI 48457 810-639-5491
 S&K Mfg. Co., P.O. Box 247, Pittsfield, PA 16340 814-563-7808; FAX: 814-563-4067
 S&S Firearms, 74-11 Myrtle Ave., Glendale, NY 11385 497-1100; FAX: 718-497-1105
 Sabatti S.r.l., via Alessandro Volta 90, 25063 Gardone V.T., Brescia, ITALY 030-8912207-831312; FAX: 030-8912059 (U.S. importer—E.A.A. Corp.)
 SAECO (See Redding Reloading Equipment)
 Saf-T-Lok, 5713 Corporate Way, Suite 100, W. Palm Beach, FL 33407
 Safari Outfitters Ltd., 71 Ethan Allan Hwy., Ridgefield, CT 06877 203-544-9505
 Safari Press, Inc., 15621 Chemical Lane B, Huntington Beach, CA 92649 714-894-9080; FAX: 714-894- 4949
 Safariland Ltd., Inc., 3120 E. Mission Blvd., P.O. Box 51478, Ontario, CA 91761 909-923-7300; FAX: 909-923-7400
 SAFE, P.O. Box 864, Post Falls, ID 83854 208-773- 3624
 Safety Speed Holster, Inc., 910 S. Vail Ave., Montebello, CA 90640 213-723-4140; FAX: 213- 726-6973
 Sako Ltd. (See U.S. importer—Stoeger Industries)
 Salter Calls, Inc., Eddie, Hwy. 31 South-Brewton Industrial Park, Brewton, AL 36426 205-867-2584; FAX: 206-867-9005
 Samco Global Arms, Inc., 6995 NW 43rd St., Miami, FL 33166 305-593-9782
 Sampson, Roger, 430 N. Grove, Mora, MN 55051 320-679-4868
 San Francisco Gun Exchange, 124 Second St., San Francisco, CA 94105 415-982-6097
 San Marco (See U.S. importers—Cape Outfitters; EMF Co., Inc.)
 Sanders Custom Gun Service, 2358 Tyler Lane, Louisville, KY 40205 502-454-3338
 Sanders Gun and Machine Shop, 145 Delhi Road, Manchester, IA 52057
 Sandia Die & Cartridge Co., 37 Atancacio Rd. NE, Albuquerque, NM 87123 505-298-5729
 Sarco, Inc., 323 Union St., Stirling, NJ, Stirling, NJ 07980 908-647-3800; FAX: 908-647-9413
 S.A.R.L. G. Granger, 66 cours Fauriel, 42100 Saint Etienne, FRANCE 04 77 25 14 73; FAX: 04 77 38 66 99
 Sauer (See U.S. importers—Paul Co., The; Sigarms, Inc.)
 Saunders Gun & Machine Shop, R.R. 2, Delhi Road, Manchester, IA 52057
 Savage Arms, Inc., 100 Springdale Rd., Westfield, MA 01085 413-568-7001; FAX: 413-562-7764
 Savage Arms (Canada), Inc., 248 Water St., P.O. Box 1240, Lakefield, Ont. K0L 2H0, CANADA 705-652- 8000; FAX: 705-652-8431
 Savage Range Systems, Inc., 100 Springdale RD., Westfield, M A 01085 413-568-7001; FAX: 413-562- 1152
 Saville Iron Co. (See Greenwood Precision)
 Savino, Barbara J., P.O. Box 1104, Hardwick, VT 05843-1104
 Scanco Environmental Systems, 5000 Highlands Parkway, Suite 180, Atlanta, GA 30082 770-431 - 0025; FAX: 770-431-0028
 Scansport, Inc., P.O. Box 700, Enfield, NH 03748 603- 632-7654
 Scattergun Technologies, Inc., 620 8th Ave. S., Nashville, TN 37203 615-254-1441; FAX: 615-254- 1449
 Sceery Game Calls, P.O. Box 6520, Sante Fe, NM 87502 505-471-9110; FAX: 505-471-3476
 Schaefer Shooting Sports, P.O. Box 1515, Melville, NY 11747-0515 516-379-4900; FAX: 516-379-6701
 Scharch Mfg., Inc., 10325 CR 120, Salida, CO 81201 539-7242, 800-836-4683; FAX: 719-539-3021
 Scherer, Box 250, Ewing, VA 24240 615-733-2615; FAX: 615-733-2073
 Schiffman, Curt, 3017 Kevin Cr., Idaho Falls, ID 83402 208-524-4684
 Schiffman, Mike, 8233 S. Crystal Springs, McCammon, ID 83250 208-254-9114
 Schiffman, Norman, 3017 Kevin Cr., Idaho Falls, ID 83402 208-524-4684
 Schmidtke Group, 17050 W. Salentine Dr., New Berlin, WI 53151-7349
 Schmidt & Bender, Inc., Brook Rd., P.O. Box 134, Meriden, NH 03770 603-469-3565, 800-468-3450; FAX: 603-469-3471
 Schmidtman Custom Ammunition, 6 Gilbert Court, Cotati, CA 94931
 Schneider Bullets, 3655 West 214th St., Fairview Park, OH 44126
 Schneider Rifle Barrels, Inc., Gary, 12202 N. 62nd Pl., Scottsdale, AZ 85254 602-948-2525

School of Gunsmithing, The, 6065 Roswell Rd., Atlanta, GA 30328 800-223-4542
 Schrimsher's Custom Knifemaker's Supply, Bob, RO. Box 308, Emory, TX 75440 903-473-3330; FAX: 903-473-2235
 Schroeder Bullets, 1421 Thermal Ave., San Diego, CA 92154 619-423-3523; FAX: 619-423-8124
 Schuetzen Pistol Works, 620-626 Old Pacific Hwy. SE, Olympia, WA 98513 360-459-3471; FAX: 360-491 - 3447
 Schulz Industries, 16247 Minnesota Ave., Paramount, CA 90723 213-439-5903
 Schumakers Gun Shop, 512 Prouty Comer Lp. A, Colville, WA 99114 509-684-4848
 Schwartz Custom Guns, David W., 2505 Waller St., Eau Claire, WI 54703 715-832-1735
 Schwartz Custom Guns, Wayne E., 970 E. Britton Rd., Morrice, MI 48857 517-625-4079
 Scobey Duck & Goose Calls, Glynn, Rt. 3, Box 37, Newbern, TN 38059 901-643-6241
 Scope Control, Inc., 5775 Co. Rd. 23 SE, Alexandria, MN 56308 612-762-7295
 ScopLevel, 151 Lindbergh Ave., Suite C, Livermore, CA 94550 510-449-5052; FAX: 510-373-0861
 Score High Gunsmithing, 9812-A, Cochiti SE, Albuquerque, NM 87123 800-326-5632, 505-292- 5532; FAX: 505-292-2592;
 E-MAIL: scorehi@rt66.com; WEB: http: www.rt66.com 6scorehi home.htm
 Scot Powder, Rt.l Box 167, McEwen, TN 37101 800-3006; FAX: 615-729-4211
 Scot Powder Co. of Ohio, Inc., Box GD96, Only, TN 37140 615-729-4207, 800-416-3006; FAX: 615-729- 4217
 Scott Fine Guns, Inc., Thad, P.O. Box 412, Indianola, MS 38751 601-887-5929
 Scott, McDougall & Associates, 7950 Redwood Dr., Cotati, CA 94931 707-546-2264; FAX: 707-795-1911
 Scott, Dwight, 23089 Englehardt St., Clair Shores, MI 48080 313-779-4735
 S.C.R.C., P.O. Box 660, Katy, TX 77492-0660 FAX: 713-578-2124
 Scruggs' Game Calls, Stanley, Rt. 1, Hwy. 661, Cullen, VA 23934 804-542-4241, 800-323-4828
 Seattle Binocular & Scope Repair Co., P.O. Box 46094, Seattle, WA 98146 206-932-3733
 Second Chance Body Armor, P.O. Box 578, Central Lake, MI 49622 616-544-5721; FAX: 616-544-9824
 Security Awareness & Firearms Education (See SAFE)
 Seebeck Assoc., R.E., P.O. Box 59752, Dallas, TX 75229
 Seecamp Co., Inc., L.W., P.O. Box 255, New Haven, CT 06502 203-877-3429
 Segway Industries, P.O. Box 783, Suffem, NY 10901- 0783 914-357-5510
 Seligman Shooting Products, Box 133, Seligman, AZ 86337 602-422-3607
 Selsi Co., Inc., P.O. Box 10, Midland Park, NJ 07432- 0010 201-935-0388; FAX: 201-935-5851
 Semmer, Charles (See Remington Double Shotguns)
 Sentinel Arms, P.O. Box 57, Detroit, MI 48231 313- 331-1951; FAX: 313-331-1456
 Serva Arms Co., Inc., RD 1, Box 483A, Greene, NY 13778 607-656-4764
 Service Armament, 689 Bergen Blvd., Ridgefield, NJ 07657
 Servus Footwear Co., 1136 2nd St., Rock Island, IL 61204-3610 309-786-7741; FAX: 309-786-9808
 S.G.S. Sporting Guns Sri., Via Della Resistenza, 37, 20090 Buccinasco (MI) ITALY 2-45702446; FAX: 2- 45702464
 Shanghai Airguns, Ltd. (U.S. importer—Sportsman Airguns, Inc.)
 Shappy Bullets, 76 Milldale Ave., Plantsville, CT 06479 203-621-3704
 Shaw, Inc., E.R. (See Small Arms Mfg. Co.)
 Sharp Shooter Supply, 4970 Lehman Road, Delphos, OH 45833 419-695-3179
 Sharps Arms Co. Inc., 100 Centennial, Box 885, Big Timber, MT 59011 406-932-4353
 Shay's Gunsmithing, 931 Marvin Ave., Lebanon, PA 17042
 Sheffield Knifemakers Supply, Inc., P.O. Box 741107, Orange City, FL 32774-1107 904-775-6453; FAX: 904-774-5754
 Shell Shack, 113 E. Main, Laurel, MT 59044 406-628- 8986
 Shepherd & Turpin Distributing Co., P.O. Box 40, Washington, UT 84780 801-635-2001
 Shepherd Scope Ltd., Box 189, Waterloo, NE 68069 779-2424; FAX: 402-779-4010
 Sheridan USA, Inc., Austin, P.O. Box 577, 36 Haddam Quarter Rd., Durham, CT 06422 203-349-1772; FAX: 203-349-1771
 Sherwood, George, 46 N. River Dr., Roseburg, OR 541-672-3159
 Shilen, Inc., 205 Metro Park Blvd., Ennis, TX 75119 972-875-5318; FAX: 972-875-5402
 Shiloh Creek, Box 357, Cottleville, MO 63338 314- 925-1842; FAX: 314-925-1842
 Shiloh Rifle Mfg., 201 Centennial Dr., Big Timber, MT 59011 406-932-4454; FAX: 406-932-5627
 Shockley, Harold H., 204 E. Farmington Rd., Hanna City, IL 61536 309-565-4524
 Shoemaker & Sons, Inc., Tex, 714 W. Cienega Ave., San Dimas, CA 91773 909-592-2071; FAX: 909-592- 2378
 Shooten' Haus, The, 102 W. 13th, Kearney, NE 68847 308-236-7929
 Shooter Shop, The, 221 N. Main, Butte, MT 59701 406-723-3842

Shooter's Choice, 16770 Hilltop Park Place, Chagrin Falls, OH 44023 216-543-8808; FAX: 216-543-8811
 Shooter's Edge, Inc., P.O.Box 769, Trinidad, CO 81082
 Shooter's World, 3828 N. 28th Ave., Phoenix, AZ 85017 602-266-0170
 Shooters Supply, 1120Tieton Dr., Yakima, WA 98902 509-452-1181
 Shootin' Accessories, Ltd., P.O. Box 6810, Auburn, CA 95604 916-889-2220
 Shootin' Shack, Inc., 1065 Silver Beach Rd., Riviera Beach, FL 33403 561-842-0990
 Shooting Chrony, Inc., 3269 Niagara Falls Blvd., N. Tonawanda, NY 14120 905-276-6292; FAX: 416- 276-6295
 Shooting Components Marketing, P.O. Box 1069, Englewood, CO 80150 303-987-2543; FAX: 303- 989-3508
 Shooting Gallery, The, 8070 Southern Blvd., Boardman, OH 44512 216-726-7788
 Shooting Specialties (See Titus, Daniel)
 Shooting Star, 1825 Fortview Rd., Ste. 115, Austin, TX 78747 512-462-0009
 Shoot-N-C Targets (See Birchwood Casey)
 Shotgun Shop, The, 14145 Proctor Ave., Suite 3, Industry, CA 91746 818-855-2737; FAX: 818-855- 2735
 Shotguns Unlimited, 2307 Fon Du Lac Rd., Richmond, VA 23229 804-752-7115
 ShurKatch Corporation, 50 Elm St., Richfield Springs, NY 13439 315-858-1470; FAX: 315-858-2969
 S.I.A.C.E. (See U.S. importer—IAR, Inc.)
 Siegrist Gun Shop, 8754 Turtle Road, Whittemore, MI 48770
 Sierra Bullets, 1400 W. Henry St., Sedalia, MO 65301 827-6300; FAX: 816-827-6300; WEB: <http://www.sierrabullets.com>
 Sierra Specialty Prod. Co., 1344 Oakhurst Ave., Los Altos, CA 94024 FAX: 415-965-1536
 SIG, CH-8212 Neuhausen, SWITZERLAND (U.S. importer—Mandall Shooting Supplies, Inc.)
 Sigarms, Inc., Corporate Park, Exeter, NH 03833 603- 772-2302; FAX: 603-772-9082
 SIG-Sauer (See U.S. importer—Sigarms, Inc.)
 Sight Shop, The, John G. Lawson, 1802 E. Columbia Ave., Tacoma, WA 98404 206-474-5465
 Sightron, Inc., 1672B Hwy. 96, Franklinton, NC 27525 528-8783; FAX: 919-528-0995
 Signet Metal Corp., 551 Stewart Ave., Brooklyn, NY 11222 718-384-5400; FAX: 718-388-7488
 Sile Distributors, Inc., 7 Centre Market Pl., New York, NY 10013 212-925-4111; FAX: 212-925-3149
 Silencio Safety Direct, 56 Coney Island Dr., Sparks, NV 89431 800-648-1812, 702-354-4451; FAX: 702- 359-1074
 Silent Hunter, 1100 Newton Ave., W. Collingswood, NJ 08107 609-854-3276
 Silhouette Leathers, P.O. Box 1161, Gunnison, CO 81230 303-641-6639
 Silhouette, The, P.O. Box 1509, Idaho Falls, ID 83403
 Silver Eagle Machining, 18007 N. 69th Ave., Glendale, AZ 85308
 Silver Ridge Gun Shop (See Goodwin, Fred)
 Silver-Tip Corp., RR2, Box 184, Gloster, MS 39638- 9520
 Simmons, Jerry, 715 Middlebury St., Goshen, IN 46526 219-533-8546
 Simmons Enterprises, Ernie, 709 East Elizabethtown Rd., Manheim, PA 17545 717-664-4040
 Simmons Gun Repair, Inc., 700 S. Rogers Rd., Olathe, KS 66062 913-782-3131; FAX: 913-782-4189
 Simmons Outdoor Corp., 201 Plantation Oak Parkway, Thomasville, GA 31792 912-227-9053; FAX: 912- 227-9054
 Sinclair International, Inc., 2330 Wayne Haven St., Fort Wayne, IN 46803 219-493-1858; FAX: 219-493- 2530
 Singletary, Kent, 2915 W. Ross, Phoenix, AZ 85027 602-582-4900
 Sipes Gun Shop, 7415 Asher Ave., Little Rock, AR 72204 501-565-8480
 Siskiyou Gun Works (See Donnelly, C.P.)
 Six Enterprises, 320-D Turtle Creek Ct., San Jose, CA 95125 408-999-0201; FAX: 408-999-0216
 SKAN A.R., 4 St. Catherines Road, Long Melford, Suffolk, CO 10 9JU ENGLAND 011-0787-312942
 SKB Arms Co. (See New SKB Arms Co.)
 SKB Shotguns, 4325 S. 120th St., P.O. Box 37669, Omaha, NE 68137 800-752-2767; FAX: 402-330- 8029
 Skeoch, Brian R., P.O. Box 279, Glenrock, WY 82637 307-436-9655; FAX: 307-436-9034
 Skip's Machine, 364 29 Road, Grand Junction, CO 81501 303-245-5417
 Sklany's Machine Shop, 566 Birch Grove Dr., Kalispell, MT 59901 406-755-4257
 SKR Industries, POB 1382, San Angelo, TX 76902 915-658-3133
 S.L.A.P. Industries, P.O. Box 1121, Parklands 2121, SOUTH AFRICA 27-11-788-0030; FAX: 27-11-788- 0030
 Slezak, Jerome F., 1290 Marlowe, Lakewood (Cleveland), OH 44107 216-221 -1668
 Slings 'N Things, Inc., 8909 Bedford Circle, Suite 11, Omaha, NE 68134 402-571-6954; FAX: 402-571- 7082
 Slug Group, Inc., P.O. Box 376, New Paris, PA 15554 814-839-4517; FAX: 814-839-2601
 Slug Site, Ozark Wilds, Rt. 2, Box 158, Versailles, MO 65084 573-378-6430
 Small Arms Mfg. Co., 5312 Thoms Run Rd., Bridgeville, PA 15017 412-221-4343; FAX: 412-221- 4303

Small Arms Specialties, 29 Bernice Ave., Leominster, MA 01453 800-635-9290
 Small Custom Mould & Bullet Co., Box 17211, Tucson, AZ 85731
 Smart Parts, 1203 Spring St., Latrobe, PA 15650 412-2660; FAX: 412-539-2298
 Smires, C.L., 5222 Windmill Lane, Columbia, MD 21044-1328
 Smith & Wesson, 2100 Roosevelt Ave., Springfield, MA 01102 413-781 -8300; FAX: 413-731 -8980
 Smith, Art, 230 Main St. S., Hector, MN 55342 320-2760; FAX: 320-848-2760
 Smith, Mark A., P.O. Box 182, Sinclair, WY 82334 307-324-7929
 Smith, Michael, 620 Nye Circle, Chattanooga, TN 37405 615-267-8341
 Smith, Ron, 5869 Straley, Ft. Worth, TX 76114 817-732-6768
 Smith, Shannon, 4545 Speas Rd., Fruitland, ID 83619 208-452-6329
 Smith Abrasives, Inc., 1700 Sleepy Valley Rd., P.O. Box 5095, Hot Springs, AR 71902-5095 501-321- 2244; FAX: 501-321-9232
 Smith Saddlery, Jesse W., 16909 E. Jackson Road, Elk, WA 99009-9600 509-325-0622
 Smokey Valley Rifles (See Lutz Engraving, Ron E.)
 Snapp's Gunshop, 6911 E. Washington Rd., Clare, MI 48617 517-386-9226
 Snider Stocks, Walter S., Rt. 2 P.O. Box 147, Denton, NC 27239
 Sno-Seal (See Atsko Sno-Seal)
 Societa Armi Bresciane Sri. (See U.S. importer—Cape Outfitters; Gamba, USA)
 Sonora Rifle Barrel Co., 14396 D. Tuolumne Rd., Sonora, CA 95370 209-532-4139
 Soque River Knives, P.O. Box 880, Clarkesville, GA 30523 706-754-8500; FAX: 706-754-7263
 SOS Products Co. (See Buck Stix—SOS Products Co.)
 Sotheby's, 1334 York Ave. at 72nd St., New York, NY 10021 212-606-7260
 Sound Technology, Box 391, Pelham, AL 35124 205- 664-5860; Summer phone: 907-486-2825
 South Bend Replicas, Inc., 61650 Oak Rd., South Bend, IN 46614 219-289-4500
 Southeastern Community College, 1015 S. Gear Ave., West Burlington, IA 52655 319-752-2731
 Southern Ammunition Co., Inc., 4232 Meadow St., Loris, SC 29569-3124 803-756-3262; FAX: 803-756- 3583
 Southern Armory, The, 25 Millstone Road, Woodlawn, VA 24381 703-238-1343; FAX: 703-238-1453
 Southern Bloomer Mfg. Co., P.O. Box 1621, Bristol, TN 37620 615-878-6660; FAX: 615-878-8761
 Southern Security, 1700 Oak Hills Dr., Kingston, TN 37763 423-376-6297; 800-251-9992
 Southwind Sanctions, P.O. Box 445, Aledo, TX 76008 817-441-8917
 Sparks, Milt, 605 E. 44th St. No. 2, Boise, ID 83714- 4800
 Spartan-Realtree Products, Inc., 1390 Box Circle, Columbus, GA 31907 706-569-9101; FAX: 706-569- 0042
 Specialty Gunsmithing, Lynn McMurdo, P.O. Box 404, Afton, WY 83110 307-886-5535
 Specialty Shooters Supply, Inc., 3325 Griffin Rd., Suite 9mm, Fort Lauderdale, FL 33317
 Speedfeed, Inc., 3820 Industrial Way, Suite N, Benicia, CA 94510 707-746-1221; FAX: 707-746-1888
 Speer Products, Div. of Blount, Inc., Sporting Equipment Div., P.O. Box 856, Lewiston, ID 83501 746-2351; FAX: 208-746-2915
 Spiegel, Craig, P.O. Box 3108, Bay City, OR 97107 503-377-2697
 Speiser, Fred D., 2229 Dearborn, Missoula, MT 59801 406-549-8133
 Spence, George W., 115 Locust St., Steele, MO 63877 314-695-4926
 Spencer Reblue Service, 1820 Tupelo Trail, Holt, MI 48842 517-694-7474
 Spencer's Custom Guns, Rt. 1, Box 546, Scottsville, VA 24590 804-293-6836
 Spezial Waffen (See U.S. importer—American Bullets)
 SPG, Inc., P.O. Box 761, Livingston, MT 59047 406- 222-8416; FAX: 406-222-8416
 Sphinx Engineering SA, Ch. des Grandes-Vies 2, CH- 2900 Porrentruy, SWITZERLAND 41 66 66 73 81; FAX: 41 66 66 30 90 (U.S. importer—Sphinx USA Inc.)
 Sphinx USA Inc., 998 N. Colony, Meriden, CT 06450 203-238-1399; FAX: 203-238-1375
 Spokhandguns, Inc., 1206 Fig St., Benton City, WA 99320 509-588-5255
 Sport Flite Manufacturing Co., P.O. Box 1082, Bloomfield Hills, MI 48303 810-647-3747
 Sporting Arms Mfg., Inc., 801 Hall Ave., Littlefield, TX 79339 806-385-5665; FAX: 806-385-3394
 Sports Innovations, Inc., P.O. Box 5181, 8505 Jacksboro Hwy., Wichita Falls, TX 76307 817-723- 6015
 Sportsman Safe Mfg. Co., 6309-6311 Paramount Blvd., Long Beach, CA 90805 800-266-7150, 310-984-5445
 Sportsman Supply Co., 714 East Eastwood, P.O. Box 650, Marshall, MO 65340 816-886-9393
 Sportsman's Communicators, 588 Radcliffe Ave., Pacific Palisades, CA 90272 800-538-3752
 Sportsmatch U.K. Ltd., 16 Summer St., Leighton Buzzard, Bedfordshire, LU7 8HT ENGLAND 01525- 381638; FAX: 01525-851236
 Sportsmen's Exchange & Western Gun Traders, Inc., 560 S. "C" St., Oxnard, CA 93030 805-483-1917

Spradlin's, 113 Arthur St., Pueblo, CO 81004 719-543- 9462; FAX: 719-543-9465
 Springfield, Inc., 420 W. Main St., Geneseo, IL 61254 944-5631; FAX: 309-944-3676
 Springfield Sporters, Inc., RD 1, Penn Run, PA 15765 254-2626; FAX: 412-254-9173
 Spyderco, Inc., 4565 N. Hwy. 93, P.O. Box 800, Golden, CO 80403 303-279-8383, 800-525-7770; FAX: 303-278-2229
 SSK Industries, 721 Woodvue Lane, Wintersville, OH 43952 614-264-0176; FAX: 614-264-2257
 Stackpole Books, 5067 Ritter Rd., Mechanicsburg, PA 17055-6921 717-796-0411; FAX: 717-796-0412
 Stalker, Inc., P.O. Box 21, Fishermans Wharf Rd., Malakoff, TX 75148 903-489-1010
 Stalwart Corporation, 76 Imperial, Unit A, Evanston, WY 82930 307-789-7687; FAX: 307-789-7688
 Stanley Bullets, 2085 Heatheridge Ln., Reno, NV 89509
 Star Ammunition, Inc., 5520 Rock Hampton Ct., Indianapolis, IN 46268 317-872-5840, 800-221-5927; FAX: 317-872-5847
 Star Bonifacio Echeverria S.A., Torrekva 3, Eibar, SPAIN 20600 43-107340; FAX: 43-101524 (U.S. importer—E.A.A. Corp.; Interarms; P.S.M.G. Gun Co.)
 Star Custom Bullets, P.O. Box 608, 468 Main St., Femdale, CA 95536 707-786-9140; FAX: 707-786- 9117
 Star Machine Works, 418 10th Ave., San Diego, CA 92101 619-232-3216
 Star Master-Match Bullets (See Star Ammunition, Inc.)
 Star Reloading Co., Inc. (See Star Ammunition, Inc.)
 Starke Bullet Company, P.O. Box 400, 605 6th St. NW, Cooperstown, ND 58425 888-797-3431
 Starkey Labs, 6700 Washington Ave. S., Eden Prairie, MN 55344
 Starkey's Gun Shop, 9430 McCombs, El Paso, TX 79924 915-751-3030
 Stark's Bullet Mfg., 2580 Monroe St., Eugene, OR 97405
 Starline, 1300 W. Henry St., Sedalia, MO 65301 816- 827-6640; FAX: 816-827-6650
 Starlight Training Center, Inc., Rt. 1, P.O. Box 88, Bronaugh, MO 64728 417-843-3555
 Starnes Gunmaker, Ken, 32900 SW Laurelvie Rd., Hillsboro, OR 97123 503-628-0705; FAX: 503-628- 6005
 Starr Trading Co., Jedediah, P.O. Box 2007, Farmington Hills, MI 48333 810-683-4343; FAX: 810-683-3282
 Starrett Co., L.S., 121 Crescent St., Athol, MA 01331 617-249-3551
 State Arms Gun Co., 815 S. Division St., Waunakee, WI 53597 608-849-5800
 Steelman's Gun Shop, 10465 Beers Rd., Swartz Creek, MI 48473 810-735-4884
 Steiner (See Pioneer Research, Inc.)
 Steffens, Ron, 18396 Mariposa Creek Rd., Willits, CA 95490 707-485-0873
 Stegall, James B., 26 Forest Rd., Wallkill, NY 12589
 Steger, James R., 1131 Dorsey Pl., Plainfield, NJ 07062
 Steves House of Guns, Rt. 1, Minnesota City, MN 55959 507-689-2573
 Stewart Game Calls, Inc., Johnny, P.O. Box 7954, 5100 Fort Ave., Waco, TX 76714 817-772-3261; FAX: 817-772-3670
 Stewart's Gunsmithing, P.O. Box 5854, Pietersburg North 0750, Transvaal, SOUTH AFRICA 01521- 89401
 Steyr Mannlicher AG & CO KG, Mannlicherstrasse 1, A-4400 Steyr, AUSTRIA 0043-7252-78621; FAX: 0043-7252-68621 (U.S. importer—GSI, Inc.; Nygord Precision Products)
 STI International, 114 Halmar Cove, Georgetown, TX 78628 800-959-8201; FAX: 512-819-0465
 Stiles Custom Guns, RD3, Box 1605, Homer City, PA 15748 412-479-9945, 412-479-8666
 Stillwell, Robert, 421 Judith Ann Dr., Schertz, TX 78154
 Stoeger Industries, 5 Mansard Ct., Wayne, NJ 07470 201-872-9500, 800-631-0722; FAX: 201-872-2230
 Stoeger Publishing Co. (See Stoeger Industries)
 Stone Enterprises Ltd., Rt. 609, P.O. Box 335, Wicomico Church, VA 22579 804-580-5114; FAX: 804-580-8421
 Stone Mountain Arms, 5988 Peachtree Comers E., Norcross, GA 30071 800-251 -9412
 Stoney Baroque Shooters Supply, John Richards, Rt. 2, Box 325, Bedford, KY 40006 502-255-7222
 Stoney Point Products, Inc., P.O. Box 234, 1815 North Spring Street, New Ulm, MN 56073-0234 507-354- 3360; FAX: 507-354-7236
 Storage Tech, 1254 Morris Ave., N. Huntingdon, PA 15642 800-437-9393
 Storey, Dale A. (See DGS, Inc.)
 Storm, Gary, P.O. Box 5211, Richardson, TX 75083 214-385-0862
 Stott's Creek Armory, Inc., 2526 S. 475W, Morgantown, IN 46160 317-878-5489
 Stott's Creek Printers, 2526 S. 475W, Morgantown, IN 46160 317-878-5489
 Stratco, Inc., P.O. Box 2270, Kalispell, MT 59901 406-1221; FAX: 406-755-1226
 Strawbridge, Victor W., 6 Pineview Dr., Dover, NH 03820 603-742-0013
 Streamlight, Inc., 1030 W. Germantown Pike, Norristown, PA 19403 215-631-0600; FAX: 610-631- 0712
 Strong Holster Co., 39 Grove St., Gloucester, MA 01930 508-281-3300; FAX: 508-281-6321
 Strutz Rifle Barrels, Inc., W.C., P.O. Box 611, Eagle River, WI 54521 715-479-4766

Stuart, V. Pat, Rt.1, Box 447-S, Greenville, VA 24440 804-556-3845
 Sturgeon Valley Sporters, K. Ide, P.O. Box 283, Vanderbilt, MI 49795 517-983-4338
 Sturm, Ruger & Co., Inc., 200 Ruger Rd., Prescott, AZ 86301 520-541-8820; FAX: 520-541-8850 "Su-Press-On," Inc., P.O. Box 09161, Detroit, MI 48209 313-842-4222 7:30-11 p.m. Mon-Thurs. Sullivan, David S. (See Westwind Rifles, Inc.)
 Summit Specialties, Inc., P.O. Box 786, Decatur, AL 35602 205-353-0634; FAX: 205-353-9818
 Sundance Industries, Inc., 25163 W. Avenue Stanford, Valencia, CA 91355 805-257-4807
 Sunny Hill Enterprises, Inc., W1790 Cty. HHH, Malone, WI 53049 414-795-4822
 Sun Welding Safe Co., 290 Easy St. No.3, Simi Valley, CA 93065 805-584-6678, 800-729-SAFE; FAX: 805- 584-6169
 Surecase Co., The, 233 Wilshire Blvd., Ste. 900, Santa Monica, CA 90401 800-92ARMLOC Sure-Shot Game Calls, Inc., P.O. Box 816, 6835 Capitol, Groves, TX 77619 409-962-1636; FAX: 409- 962-5465
 Survival Arms, Inc., P.O. Box 965, Orange, CT 06477 203-924-6533; FAX: 203-924-2581
 Svon Corp., 280 Eliot St., Ashland, MA 01721 508- 881-8852
 Swampfire Shop, The (See Peterson Gun Shop, Inc., A.W.)
 Swann, D.J., 5 Orsova Close, Eltham North, Vic. 3095, AUSTRALIA 03-431-0323
 Swannndri New Zealand, 152 Elm Ave., Burlingame, CA 94010 415-347-6158
 SwaroSports, Inc. (See J%cgerSport, Ltd.)
 Swarovski Optik North America Ltd., One Wholesale Way, Cranston, RI 02920 401-946-2220, 800-426- 3089; FAX: 401-946-2587
 Sweet Home, Inc., P.O. Box 900, Orrville, OH 44667- 0900
 Swenson's 45 Shop, A.D., P.O. Box 606, Fallbrook, CA 92028
 Swift Bullet Co., P.O. Box 27, 201 Main St., Quinter, KS 67752 913-754-3959; FAX: 913-754-2359
 Swift Instruments, Inc., 952 Dorchester Ave., Boston, MA 02125 617-436-2960; FAX: 617-436-3232
 Swift River Gunworks, 450 State St., Belchertown, MA 01007 413-323-4052
 Swiss Army Knives, Inc., 151 Long Hill Crossroads, 37 Canal St., Shelton, CT 06484 800-243-4032
 Swivel Machine Works, Inc., 11 Monitor Hill Rd., Newtown, CT 06470 203-270-6343
 Zweda, Robert (See RMS Custom Gunsmithing)

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Tabler Marketing, 2554 Lincoln Blvd., Suite 555, Marina Del Rey, CA 90291 818-755-4565; FAX: 818-755-0972
 TacStar Industries, Inc., 218 Justin Drive, P.O. Box 70, Cottonwood, AZ 86326 602-639-0072; FAX: 602- 634-8781
 TacTell, Inc., P.O. Box 5654, Maryville, TN 37802 982-7855; FAX: 615-558-8294
 Tactical Defense Institute, 574 Miami Bluff Ct., Loveland, OH 45140 513-677-8229
 Talbot QD Mounts, 2210 E. Grand Blanc Rd., Grand Blanc, MI 48439-8113 810-695-2497
 Talley, Dave, P.O. Box 821, Glenrock, WY 82637 307- 436-8724, 307-436-9315
 Talmage, William G., 10208 N. County Rd. 425 W., Brazil, IN 47834 812-442-0804
 Talon Mfg. Co., Inc., 621 W. King St., Martinsburg, WV 25401 304-264-9714; FAX: 304-264-9725
 Tamarack Products, Inc., P.O. Box 625, Wauconda, IL 60084 708-526-9333; FAX: 708-526-9353
 Tanfoglio Fratelli S.r.l., via Valtrompia 39, 41, 25068 Gardone V.T., Brescia, ITALY 30-8910361; FAX: 30-8910183 (U.S. importer—E.A.A. Corp.) Tanglefree Industries, 1261 Heavenly Dr., Martinez, CA 94553 800-982-4868; FAX: 510-825-3874
 Tank's Rifle Shop, P.O. Box 474, Fremont, NE 68026- 0474 402-727-1317; FAX: 402-721-2573
 Tanner (See U.S. importer—Mandall Shooting Supplies, Inc.)
 Taracorp Industries, Inc., 1200 Sixteenth St., Granite City, IL 62040 618-451-4400
 Tar-Hunt Custom Rifles, Inc., RR3, P.O. Box 572, Bloomsburg, PA 17815-9351 717-784-6368; FAX: 717-784-6368
 Tamhelm Supply Co., Inc., 431 High St., Boscawen, NH 03303 603-796-2551; FAX: 603-796-2918
 Tasco Sales, Inc., 7600 NW 26th St., Miami, FL 33122- 1494 305-591-3670; FAX: 305-592-5895
 Taurus Firearms, Inc., 16175 NW 49th Ave., Miami, FL 33014 305-624-1115; FAX: 305-623-7506
 Taurus International Firearms (See U.S. importer— Taurus Firearms, Inc.)
 Taurus S.A., Fojias, Avenida Do Forte 511, Porto Alegre, RS BRAZIL 91360 55-51-347-4050; FAX: 55-51-347-3065
 Taylor & Robbins, P.O. Box 164, Rixford, PA 16745 814-966-3233
 Taylor's & Co., Inc., 304 Lenoir Dr., Winchester, VA 22603 540-722-2017; FAX: 540-722-2018
 TCCI, P.O. Box 302, Phoenix, AZ 85001 602-237- 3823; FAX: 602-237-3858
 TCSR, 3998 Hoffman Rd., White Bear Lake, MN 55110-4626 800-328-5323; FAX: 612-429-0526
 TDP Industries, Inc., 606 Airport Blvd., Doylestown, PA 18901 215-345-8687; FAX: 215-345-6057

Techni-Mec (See F.A.I.R. Techni-Mec s.n.c. di Isidoro Rizzini & C.)
 Techno Arms (See U.S. importer—Auto-Ordnance Corp.)
 Tecnolegno S.p.A., Via A. Locatelli, 6, 10, 24019 Zogno, ITALY 0345-55111; FAX: 0345-55155
 Tele-Optics, 5514 W. Lawrence Ave., Chicago, IL 60630 773-283-7757; FAX: 773-283-7757
 Ten-Ring Precision, Inc., Alex B. Hamilton, 1449 Blue Crest Lane, San Antonio, TX 78232 210-494-3063; FAX: 210-494-3066
 10-X Products Group, 2915 Lyndon B. Johnson Freeway, Suite 133, Dallas, TX 75234 972-243-4016, 433-2225; FAX: 972-243-4112
 Tennessee Valley Mfg., P.O. Box 1175, Corinth, MS 38834 601-286-5014
 Tepeco, P.O. Box 342, Friendswood, TX 77546 713-482-2702
 Testing Systems, Inc., 220 Pegasus Ave., Northvale, NJ 07647
 Teton Arms, Inc., P.O. Box 411, Wilson, WY 83014 307-733-3395
 Tetra Gun Lubricants (See FTI, Inc.)
 Texas Armory (See Bond Arms, Inc.)
 Texas Longhorn Arms, Inc., 5959 W. Loop South, Suite 424, Bellaire, TX 77401 713-660-6323; FAX: 713- 660-0493
 Texas Platers Supply Co., 2453 W. Five Mile Parkway, Dallas, TX 75233 214-330-7168
 T.F.C. S.p.A., Via G. Marconi 118, B, Villa Carcina, Brescia 25069, ITALY 030-881271; FAX: 030- 881826
 Theis, Terry, P.O. Box 535, Fredericksburg, TX 78624 210-997-6778
 Theoben Engineering, Stephenson Road, St. Ives, Huntingdon, Cambs., PE17 4WJ ENGLAND 011- 0480-461718
 Thiewes, George W., 14329 W. Parada Dr., Sun City West, AZ 85375
 Things Unlimited, 235 N. Kimbau, Casper, WY 82601 307-234-5277
 Thirion Gun Engraving, Denise, P.O. Box 408, Graton, CA 95444 707-829-1876
 Thomas, Charles C., 2600 S. First St., Springfield, IL 62794 217-789-8980; FAX: 217-789-9130
 Thompson, Norm, 18905 NW Thurman St., Portland, OR 97209
 Thompson, Randall (See Highline Machine Co.)
 Thompson Bullet Lube Co., P.O. Box 472343, Garland, TX 75047-2343 972-271-8063; FAX: 972-840-6743
 Thompson Center Arms, P.O. Box 5002, Rochester, NH 03866 603-332-2394; FAX: 603-332-5133
 Thompson Precision, 110 Mary St., P.O. Box 251, Warren, IL 61087 815-745-3625
 Thompson Target Technology, 618 Roslyn Ave., SW, Canton, OH 44710 216-453-7707; FAX: 216-478- 4723
 Thompson Tool Mount (See TTM)
 3-D Ammunition & Bullets, 112 W. Plum St., P.O. Box J, Doniphan, NE 68832 845-2285, 800-255-6712; FAX: 402-845-6546
 300 Below Services (See Cryo-Accurizing)
 300 Gunsmith Service, Inc., at Cherry Creek State Park Shooting Center, 12500 E. Belleview Ave. Englewood, CO 80111 303-690-3300
 3-Ten Corp., P.O. Box 269, Feeding Hills, MA 01030 789-2086; FAX: 413-789-1549
 T.H.U. Enterprises, Inc., P.O. Box 418, Lederach, PA 19450 215-256-1665; FAX: 215-256-9718
 Thunder Mountain Arms, P.O. Box 593, Oak Harbor, WA 98277 206-679-4657; FAX: 206-675-1114
 Thunderbird Cartridge Co., Inc. (See TCCI)
 Thurston Sports, Inc., RD 3 Donovan Rd., Auburn, NY 13021 315-253-0966
 Tiger-Hunt, Box 379, Beaverdale, PA 15921 814-472- 5161
 Tikka (See U.S. importer—Stoeger Industries)
 Timber Heirloom Products, 618 Roslyn Ave. SW, Canton, OH 44710 216-453-7707; FAX: 216-478- 4723
 Time Precision, Inc., 640 Federal Rd., Brookfield, CT 06804 203-775-8343
 Timney Mfg., Inc., 3065 W. Fairmont Ave., Phoenix, AZ 85017 602-274-2999; FAX: 602-241-0361
 Tink's Safariland Hunting Corp., P.O. Box 244, 1140 Monticello Rd., Madison, GA 30650 706-342-4915; FAX: 706-342-7568
 Tinks & Ben Lee Hunting Products (See Wellington Outdoors)
 Tioga Engineering Co., Inc., P.O. Box 913,13 Cone St., Wellsboro, PA 16901 717-724-3533, 717-662-3347
 Tippman Pneumatics, Inc., 3518 Adams Center Rd., Fort Wayne, IN 46806 219-749-6022; FAX: 219-749- 6619
 Tirelli, Snc Di Tirelli Primo E.C., Via Matteotti No. 359, Gardone V.T., Brescia, ITALY 25063 030- 8912819; FAX: 030-832240
 Titus, Daniel, Shooting Specialties, 119 Morlyn Ave., Bryn Mawr, PA 19010-3737 215-525-8829
 TMI Products (See Haselbauer Products, Jerry)
 TM Stockworks, 6355 Maplecrest Rd., Fort Wayne, IN 46835 219-485-5389
 Tom's Gun Repair, Thomas G. Ivanoff, 76-6 Rt. Southfork Rd., Cody, WY 82414 307-587-6949
 Tom's Gunshop, 3601 Central Ave., Hot Springs, AR 71913 501-624-3856
 Tomboy, Inc., P.O. Box 846, Dallas, OR 97338 503-623-8405

Tombstone Smoke'n'Deals, 3218 East Bell Road, Phoenix, AZ 85032 602-905-7013; Fax: 602-443- 1998
 Tonoloway Tack Drives, HCR 81, Box 100, Needmore, PA 17238
 Tooley Custom Rifles, 516 Creek Meadow Dr., Gastonia, NC 28054 704-864-7525
 Top-Line USA, Inc., 7920-28 Hamilton Ave., Cincinnati, OH 45231 513-522-2992, 800-346-6699; FAX: 513-522-0916
 Torel, Inc., 1708 N. South St., P.O. Box 592, Yoakum, TX 77995 512-293-2341; FAX: 512-293-3413
 Totally Dependable Products (See TDP Industries, Inc.)
 TOZ (See U.S. importer—Nygord Precision Products)
 TR Metals Corp., 1 Pavilion Ave., Riverside, NJ 08075 461-9000; FAX: 609-764-6340
 Track of the Wolf, Inc., P.O. Box 6, Osseo, MN 55369- 0006 612-424-2500; FAX: 612-424-9860
 TracStar Industries, Inc., 218 Justin Dr., Cottonwood, AZ 86326 520-639-0072; FAX: 520-634-8781
 Tradewinds, Inc., P.O. Box 1191, 2339-41 Tacoma Ave. S., Tacoma, WA 98401 206-272-4887
 Traditions, Inc., P.O. Box 776, 1375 Boston Post Rd., Old Saybrook, CT 06475 860-388-4656; FAX: 860-388-4657
 Trafalgar Square, P.O. Box 257, N. Pomfret, VT 05053 802-457-1911
 Traft Gunshop, P.O. Box 1078, Buena Vista, CO 81211
 TrailTimer Co., 1992-A Suburban Ave., P.O. Box 19722, St. Paul, MN 55119 612-738-0925
 Trail Visions, 5800 N. Ames Terrace, Glendale, WI 53209 414-228-1328
 Trammco, 839 Gold Run Rd., Boulder, CO 80302
 Trappers Trading, P.O. Box 26946, Austin, TX 78755 800-788-9334
 Trax America, Inc., P.O. Box 898, 1150 Eldridge, Forrest City, AR 72335 501-633-0410, 800-232- 2327; FAX: 501-633-4788
 Treadlok Gun Safe, Inc., 1764 Granby St. NE, Roanoke, VA 24012 800-729-8732, 703-982-6881; FAX: 703- 982-1059
 Treemaster, P.O. Box 247, Guntersville, AL 35976 205-878-3597
 Tresco, Inc., P.O. Box 4640, Pagosa Springs, CO 81157 303-731-2295
 Trevallion Gunstocks, 9 Old Mountain Rd., Cape Neddick, ME 03902 207-361-1130 de Treville & Co., Stan, 4129 Normal St., San Diego, CA 92103 619-298-3393
 Trico Plastics, 590 S. Vincent Ave., Azusa, CA 91702
 Trigger Lock Division Central Specialties Ltd., 1122 Silver Lake Road, Cary, IL 60013 847-639-3900; FAX: 847-639-3972
 Trijicon, Inc., 49385 Shafer Ave., P.O. Box 930059, Wixom, MI 48393-0059 810-960-7700; FAX: 810- 960-7725
 Trilux Inc., P.O. Box 24608, Winston-Salem, NC 27114 910-659-9438; FAX: 910-768-7720
 Trinidad State Junior College, Gunsmithing Dept., 600 Prospect St., Trinidad, CO 81082 719-846-5631; FAX: 719-846-5667
 Triple-K Mfg. Co., Inc., 2222 Commercial St., San Diego, CA 92113 619-232-2066; FAX: 619-232-7675
 Tristar Sporting Arms, Ltd., 1814-16 Linn St., P.O. Box 7496, N. Kansas City, MO 64116 816-421-1400; FAX: 816-421-4182
 Trius Products, Inc., P.O. Box 25, 221 S. Miami Ave., Cleves, OH 45002 513-941-5682; FAX: 513-941- 7970
 Trooper Walsh, 2393 N. Edgewood St., Arlington, VA 22207
 Trophy Bonded Bullets, Inc., 900 S. Loop W., Suite 190, Houston, TX 77054 713-645-4499, 888-308- 3006; FAX: 713-741-6393
 Trotman, Ken, 135 Ditton Walk, Unit 11, Cambridge CB5 8PY, ENGLAND 01223-211030; FAX: 01223- 212317
 Tru-Balance Knife Co., P.O. Box 140555, Grand Rapids, MI 49514 616-453-3679
 Tru-Square Metal Prods., Inc., 640 First St. SW, P.O. Box 585, Auburn, WA 98071 206-833-2310; FAX: 206-833-2349
 True Flight Bullet Co., 5581 Roosevelt St., Whitehall, PA 18052 610-262-7630; FAX: 610-262-7806
 Trulock Tool, Broad St., Whigham, GA 31797 912- 762-4678
 TTM, 1550 Solomon Rd., Santa Maria, CA 93455 SOS- 934-1281
 Tucker, James C., P.O. Box 575, Raymond, NH 03077
 Tucson Mold, Inc., 930 S. Plumer Ave., Tucson, AZ 85719 520-792-1075; FAX: 520-792-1075
 Turkish Firearms Corp., 522 W. Maple St., Allentown, PA 18101 610-821-8660; FAX: 610-821-9049
 Turnbull Restoration, Doug, 6426 County Rd. 30, P.O. Box 471, Bloomfield, NY 14469 716-657-6338; WEB: <http://gunshop.com/doug.htm>
 Tuttle, Dale, 4046 Russell Rd., Muskegon, MI 49445 616-766-2250
 Twin Pine Armory, P.O. Box 58, Hwy. 6, Adna, WA 98522 360-748-4590; FAX: 360-748-1802
 Tyler Manufacturing & Distributing, 3804 S. Eastern, Oklahoma City, OK 73129 405-677-1487, 800-654- 8415

U

Uberti USA, Inc., P.O. Box 469, Lakeville, CT 06039
 435-8068; FAX: 860-435-8146
 Uberti, Aldo, Casella Postale 43,1-25063 Gardone V.T., ITALY (U.S. importers—American Arms, Inc.; Cabela's; Cimarron Arms; Dixie Gun Works; EMF Co., Inc.; Forgett Jr., Valmore J.; IAR, Inc.; Navy Arms Co; Taylor's & Co., Inc.; Uberti USA, Inc.)

UFA, Inc., 6927 E. Grandview Dr., Scottsdale, AZ 85254 800-616-2776
 Ugartechea S.A., Ignacio, Chonta 26, Eibar, SPAIN 20600 43-121257; FAX: 43-121669 (U.S. importer— Aspen Outfitting Co.; The Gun Shop; Bill Hanus Birdguns; Lion Country Supply)
 Ultimate Accuracy, 121 John Shelton Rd., Jacksonville, AR 72076 501-985-2530
 Ultra Dot Distribution, 2316 N.E. 8th Rd., Ocala, FL 34470
 Ultra Light Arms, Inc., P.O. Box 1270, 214 Price St., Granville, WV 26505 304-599-5687; FAX: 304-599- 5687
 Ultralux (See U.S. importer—Keng's Firearms Specialty, Inc.)
 UltraSport Arms, Inc., 1955 Norwood Ct., Racine, WI 53403 414-554-3237; FAX: 414-554-9731
 Uncle Bud's, HCR 81, Box 100, Needmore, PA 17238 717-294-6000; FAX: 717-294-6005
 Uncle Mike's (See Michaels of Oregon Co.)
 Unertl Optical Co., Inc., John, 308 Clay Ave., P.O. Box 818, Mars, PA 16046-0818 412-625-3810
 Unique M.A.P.F., 10, Les Allees, 64700 Hendaye, FRANCE 64700 33-59 20 71 93 (U.S. importer— Nygord Precision Products)
 UniTec, 1250 Bedford SW, Canton, OH 44710 216-452-4017
 United Binocular Co., 9043 S. Western Ave., Chicago, IL 60620
 United Cutlery Corp., 1425 United Blvd., Sevierville, TN 37876 615-428-2532, 800-548-0835; FAX: 615- 428-2267
 United States Ammunition Co. (See USAC)
 United States Optics Technologies, Inc., 5900 Dale St., Buena Park, CA 90621 714-994-4901; FAX: 714- 994-4904
 United States Products Co., 518 Melwood Ave., Pittsburgh, PA 15213 412-621-2130
 Unmussig Bullets, D.L., 7862 Brentford Drive, Richmond, VA 23225 804-320-1165
 Upper Missouri Trading Co., 304 Harold St., Crofton, NE 68730 402-388-4844
 USAC, 4500-15th St. East, Tacoma, WA 98424 206-922-7589
 U.S.A. Magazines, Inc., P.O. Box 39115, Downey, CA 90241 800-872-2577
 USA Sporting Inc., 1330 N. Glassell, Unit M, Orange, CA 92667 714-538-3109, 800-538-3109; FAX: 714- 538-1334
 U.S. Patent Fire Arms, No. 25-55 Van Dyke Ave., Hartford, CT 06106 800-877-2832; FAX: 800-644- 7265
 U.S. Repeating Arms Co., Inc., 275 Winchester Ave., Morgan, UT 84050-9333 801-876-3440; FAX: 801- 876-3737
 Utica Cutlery Co., 820 Noyes St., Utica, NY 13503 733-4663; FAX: 315-733-6602
 Uvalde Machine & Tool, P.O. Box 1604, Uvalde, TX 78802

V

Valade Engraving, Robert, 931 3rd Ave., Seaside, OR 97138 503-738-7672
 Valmet (See Tikka U.S. importer—Stoeger Industries)
 Valor Corp., 5555 NW 36th Ave., Miami, FL 33142 633-0127; FAX: 305-634-4536
 Van Epps, Milton (See Van's Gunsmith Service)
 Van's Gunsmith Service, 224 Route 69-A, Parish, NY 13131 315-625-7251
 VanGorden & Son, Inc., C.S., 1815 Main St., Bloomer, WI 54724 715-568-2612
 Van Horn, Gil, P.O. Box 207, Llano, CA 93544
 Van Patten, J.W., P.O. Box 145, Foster Hill, Milford, PA 18337 717-296-7069
 Vancini, Carl (See Bestload, Inc.)
 Vann Custom Bullets, 330 Grandview Ave., Novato, CA 94947
 Varner's Service, 102 Shaffer Rd., Antwerp, OH 45813 419-258-8631
 Vega Tool Co., c o T.R. Ross, 4865 Tanglewood Ct., Boulder, CO 80301 303-530-0174
 Venco Industries, Inc. (See Shooter's Choice)
 Venus Industries, P.O. Box 246, Sialkot-1, PAKISTAN FAX: 92 432 85579
 Vemey-Carron, B.P. 72,54 Boulevard Thiers, 42002 St. Etienne Cedex 1, FRANCE 33-477791500; FAX: 33- 477790702; E-MAIL: Vemey-Carron@mail.com
 Versa-Pod (See Keng's Firearms Specialty, Inc.)
 Vest, John, P.O. Box 1552, Susanville, CA 96130 916-257-7228
 VibraShine, Inc., P.O. Box 577, Taylorsville, MS 39168 785-9854; FAX: 601-785-9874
 Vibra-Tek Co., 1844 Arroya Rd., Colorado Springs, CO 80906 719-634-8611; FAX: 719-634-6886
 Vic's Gun Refinishing, 6 Pineview Dr., Dover, NH 03820-6422 603-742-0013
 Victory USA, P.O. Box 1021, Pine Bush, NY 12566 744-2060; FAX: 914-744-5181
 Vihtavuori Oy, FIN-41330 Vihtavuori, FINLAND 358- 41-3779211; FAX: 358-41-3771643
 Vihtavuori Oy Kaltron-Pettibone, 1241 Ellis St., Bensenville, IL 60106 708-350-1116; FAX: 708-350- 1606
 Viking Leathercraft, Inc., 1579A Jayken Way, Chula Vista, CA 91911 800-262-6666; FAX: 619-429-8268
 Viking Video Productions, P.O. Box 251, Roseburg, OR 97470
 Vincent's Shop, 210 Antoinette, Fairbanks, AK 99701
 Vintage Arms, Inc., 6003 Saddle Horse, Fairfax, VA 22030 703-968-0779; FAX: 703-968-0780

Vintage Industries, Inc., 781 Big Tree Dr., Longwood, FL 32750 407-831-8949; FAX: 407-831-5346
 Viper Bullet and Brass Works, 11 Brock St., Box 582, Norwich, Ontario, CANADA NOJ 1P0
 Viramontez, Ray, 601 Springfield Dr., Albany, GA 31707 912-432-9683
 Visible Impact Targets, Rts. 5 & 20, E. Bloomfield, NY 14443 716-657-6161; FAX: 716-657-5405
 Vitt Boos, 2178 Nichols Ave., Stratford, CT 06497 203-375-6859
 Voere-KGH m.b.H., P.O. Box 416, A-6333 Kufstein, Tirol, AUSTRIA 0043-5372-62547; FAX: 0043- 5372-65752 (U.S. importers—J%agerSport, Ltd.)
 Volquartsen Custom Ltd., 24276 240th Street, P.O. Box 271, Carroll, IA 51401 712-792-4238; FAX: 712-792- 2542
 Vom Hoffe (See Old Western Scrounger, Inc., The)
 Von Minden Gunsmithing Services, 2403 SW 39 Terrace, Cape Coral, FL 33914 813-542-8946
 Vorhes, David, 3042 Beecham St., Napa, CA 94558 707-226-9116
 Vortek Products, Inc., P.O. Box 871181, Canton, MI 48187-6181 313-397-5656; FAX: 313-397-5656
 VSP Publishers (See Heritage VSP Gun Books)
 Vulpes Ventures, Inc., Fox Cartridge Division, P.O. Box 1363, Bolingbrook, IL 60440-7363 708-759- 1229

W

Wagoner, Vernon G., 2325 E. Encanto, Mesa, AZ 85213 602-835-1307
 Wakina by Pic, 24813 Alderbrook Dr., Santa Clarita, CA 91321 800-295-8194
 Waldron, Herman, Box 475, 80 N. 17th St., Pomeroy, WA 99347 509-843-1404
 Walker Arms Co., Inc., 499 County Rd. 820, Selma, AL 36701 334-872-6231; FAX: 334-872-6262
 Walker Mfg., Inc., 8296 S. Channel, Harsen's Island, MI 48028
 Walker Co., B.B., P.O. Box 1167, 414 E. Dixie Dr., Asheboro, NC 27203 910-625-1380; FAX: 910-625- 8125
 Wallace, Terry, 385 San Marino, Vallejo, CA 94589 707-642-7041
 Waller & Son, Inc., W., 2221 Stoney Brook Road, Grantham, NH 03753-7706 603-863-4177
 Walls Industries, Inc., P.O. Box 98, 1905 N. Main, Cleburne, TX 76031 817-645-4366; FAX: 817-645- 7946
 Walnut Factory, The, 235 West Rd. No. 1, Portsmouth, NH 03801 603-436-2225; FAX: 603-433-7003
 Walt's Custom Leather, Walt Whinnery, 1947 Meadow Creek Dr., Louisville, KY 40218 502-458-4361
 Walters Industries, 6226 Park Lane, Dallas, TX 75225 214-691-6973
 Walters, John, 500 N. Avery Dr., Moore, OK 73160 405-799-0376
 Walther GmbH, Carl, B.P. 4325, D-89033 Ulm, GERMANY (U.S. importer—Champion's Choice; Interarms; P.S.M.G. Gun Co.)
 WAMCO, Inc., Mingo Loop, P.O. Box 337, Oquossoc, ME 04964-0337 207-864-3344
 WAMCO—New Mexico, P.O. Box 205, Peralta, NM 87042-0205 505-869-0826
 Ward & Van Valkenburg, 114 32nd Ave. N., Fargo, ND 58102 701-232-2351
 Ward Machine, 5620 Lexington Rd., Corpus Christi, TX 78412 512-992-1221
 Wardell Precision Handguns Ltd., 48851 N. Fig Springs Rd., New River, AZ 85027-8513 602-465-7995
 Warenski, Julie, 590 E. 500 N., Richfield, UT 84701
 896-5319; FAX: 801-896-5319
 Warae Manufacturing Co., 9039 SE Janssen Rd., Clackamas, OR 97015 503-657-5590, 800-683-5590; FAX: 503-657-5695
 Warren & Sweat Mfg. Co., P.O. Box 350440, Grand Island, FL 32784 904-669-3166; FAX: 904-669-7272
 Warren Muzzleloading Co., Inc., Hwy. 21 North, P.O. Box 100, Ozone, AR 72854 501-292-3268
 Warren, Kenneth W. (See Mountain States Engraving)
 Washita Mountain Whetstone Co., P.O. Box 378, Lake Hamilton, AR 71951 501 -525-3914
 Wasmundt, Jim, P.O. Box 511, Fossil, OR 97830
 WASP Shooting Systems, Rt. 1, Box 147, Lakeview, AR 72642 501-431-5606
 Waterfield Sports, Inc., 13611 Country Lane, Burnsville, MN 55337 612-435-8339
 Watson Bros., 39 Redcross Way, London Bridge, London, United Kingdom, SE1 1HG FAX: 44-171-403-3367
 Watson Trophy Match Bullets, 2404 Wade Hampton Blvd., Greenville, SC 29615 864-244-7948; 941-635- 7948 (Florida)
 Watsontown Machine & Tool Co., 309 Dickson Ave., Watsontown, PA 17777 717-538-3533
 Wayne Firearms for Collectors and Investors, James, 2608 N. Laurent, Victoria, TX 77901 512-578-1258; FAX: 512-578-3559
 Wayne Specialty Services, 260 Waterford Drive, Florissant, MO 63033 413-831-7083
 WD-40 Co., 1061 Cudahy Pl., San Diego, CA 92110 619-275-1400; FAX: 619-275-5823
 Weatherby, Inc., 3100 El Camino Real, Atascadero, CA 93422 805-466-1767, 800-227-2016, 800-334-4423 (Calif.); FAX: 805-466-2527
 Weaver Arms Corp. Gun Shop, RR 3, P.O. Box 266, Bloomfield, MO 63825-9528
 Weaver Products, P.O. Box 39, Onalaska, WI 54650
 648-9624, 608-781-5800; FAX: 608-781-0368
 Weaver Scope Repair Service, 1121 Larry Mahan Dr., Suite B, El Paso, TX 79925 915-593-1005

Webb, Bill, 6504 North Bellefontaine, Kansas City, MO 64119 816-453-7431
 Weber & Markin Custom Gunsmiths, 4-1691 Powick Rd., Kelowna, B.C. CANADA V1X 4L1 250-762- 7575; FAX: 250-861-3655
 Weber Jr., Rudolf, P.O. Box 160106, D-5650 Solingen, GERMANY 0212-592136
 Webley and Scott Ltd., Frankley Industrial Park, Tay Rd., Rubery, Rednal, Birmingham B45 0PA, ENGLAND 011-021-453-1864;
 FAX: 021-457-7846 (U.S. importer—Beeman Precision Airguns; Groenewold, John)
 Webster Scale Mfg. Co., P.O. Box 188, Sebring, FL 33870 813-385-6362
 Weems, Cecil, P.O. Box 657, Mineral Wells, TX 76067 817-325-1462
 Weigand Combat Handguns, Inc., 685 South Main Rd., Mountain Top, PA 18707 717-868-8358; FAX: 717- 868-5218
 Weihrauch KG, Hermann, Industriestrasse 11, 8744 Mellrichstadt, GERMANY 09776-497-498 (U.S. importers—Beeman Precision
 Airguns; E.A.A. Corp.)
 Weisz Parts, P.O. Box 20038, Columbus, OH 43220- 0038 614-45-70-500; FAX: 614-846-8585
 Welch, Sam, CVSR 2110, Moab, UT 84532 801-259- 8131
 Wellington Outdoors, P.O. Box 244, 1140 Monticello Rd., Madison, GA 30650 706-342-4915; FAX: 706- 342-7568
 Wells Creek Knife & Gun Works, 32956 State Hwy. 38, Scottsburg, OR 97473 541-587-4202; FAX: 541-587- 4223
 Wells Custom Gunsmith, R.A., 3452 1st Ave., Racine, WI 53402 414-639-5223
 Wells, Fred F., Wells Sport Store, 110N. Summit St., Prescott, AZ 86301 520-445-3655
 Wells, Rachel, HON. Summit St., Prescott, AZ 86301 520-445-3655
 Welsh, Bud, 80 New Road, E. Amherst, NY 14051 716- 688-6344
 Wenig Custom Gunstocks, Inc., 103 N. Market St., P.O. Box 249, Lincoln, MO 65338 816-547-3334; FAX: 816-547-2881
 Wemer, Carl, P.O. Box 492, Littleton, CO 80160 Werth, T.W., 1203 Woodlawn Rd., Lincoln, IL 62656 217-732-1300
 Wescombe, Bill (See North Star West)
 Wessinger Custom Guns & Engraving, 268 Limestone Rd., Chapin, SC 29036 803-345-5677
 Wesson Firearms, Dan, 119 Kemper Lane, Norwich, NY 13815 607-336-1174; FAX: 607-336-2730
 West, Jack L., 1220 W. Fifth, P.O. Box 427, Arlington, OR 97812
 West, Robert G., 3973 Pam St., Eugene, OR 97402 541-344-3700
 Western Cutlery (See Camillus Cutlery Co.)
 Western Design (See Alpha Gunsmith Division)
 Western Gunstock Mfg. Co., 550 Valencia School Rd., Aptos, CA 95003 408-688-5884
 Western Missouri Shooters Alliance, P.O. Box 11144, Kansas City, MO 64119 816-597-3950; FAX: 816- 229-7350
 Western Munitions (See North American Munitions)
 Western Nevada West Coast Bullets, 2307 W. Washington St., Carson City, NV 89703 702-246- 3941; FAX: 702-246-0836
 Westfield Engineering, 6823 Watcher St., Commerce, CA 90040 FAX: 213-928-8270
 Westley Richards Agency USA (U.S. importer for Westley Richards & Co.)
 Westley Richards & Co., 40 Grange Rd., Birmingham, ENGLAND B29 6AR 010-214722953 (U.S. importer—Westley Richards
 Agency USA)
 Westrom, John (See Precision Metal Finishing)
 Westwind Rifles, Inc., David S. Sullivan, P.O. Box 261, 640 Briggs St., Erie, CO 80516 303-828-3823
 Weyer International, 2740 Nebraska Ave., Toledo, OH 43607 419-534-2020; FAX: 419-534-2697
 Whildin & Sons Ltd., E.H., RR2, Box 119, Tamaqua, PA 18252 717-668-6743; FAX: 717-668-6745
 Whinnery, Walt (See Walt's Custom Leather)
 Whiscombe (See U.S. importer—Pelaide Products)
 White Flyer Targets, 124 River Road, Middlesex, NJ 08846 908-469-0100, 602-972-7528 (Export); FAX: 908-469-9692,
 602-530-3360 (Export)
 White Laboratory, Inc., H.P., 3114 Scarboro Rd., Street, MD 21154 410-838-6550; FAX: 410-838-2802
 White Owl Enterprises, 2583 Flag Rd., Abilene, KS 67410 913-263-2613; FAX: 913-263-2613
 White Pine Photographic Services, Hwy. 60, General Delivery, Wilno, Ontario K0J 2N0 CANADA 613-756-3452
 White Rock Tool & Die, 6400 N. Brighton Ave., Kansas City, MO 64119 816-454-0478
 White Muzzleloading Systems, 25 E. Hwy. 40, Suite 330-12, Roosevelt, UT 84066 801-722-5996; FAX: 801-722-5909
 White Shooting Systems (See White Muzzleloading Systems)
 Whitehead, James D., 204 Cappucino Way, Sacramento, CA 95838
 Whitestone Lumber Corp., 148-02 14th Ave., Whitestone, NY 11357 718-746-4400; FAX: 718-767-1748
 Whitetail Design & Engineering Ltd., 9421 E.
 Mannsiding Rd., Clare, MI 48617 517-386-3932
 Whits Shooting Stuff, Box 1340, Cody, WY 82414
 Wichita Arms, Inc., 923 E. Gilbert, P.O. Box 11371, Wichita, KS 67211 316-265-0661; FAX: 316-265- 0760
 Wick, David E., 1504 Michigan Ave., Columbus, IN 47201 812-376-6960

Widener's Reloading & Shooting Supply, Inc., P.O. Box 3009 CRS, Johnson City, TN 37602 615-282- 6786; FAX: 615-282-6651

Wideview Scope Mount Corp., 13535 S. Hwy. 16, Rapid City, SD 57701 605-341-3220; FAX: 605-341- 9142

Wiebe, Duane, 33604 Palm Dr., Burlington, WI 53105- 9260

Wiest, M.C., 10737 Dutchtown Rd., Knoxville, TN 37932 423-966-4545

Wilcox All-Pro Tools & Supply, 4880 147th St., Montezuma, IA 50171 515-623-3138; FAX: 515-623- 3104

Wild Bill's Originals, P.O. Box 13037, Burton, WA 98013 206-463-5738

Wild West Guns, 7521 Old Seward Hwy, Unit A, Anchorage, AK 99518 800-992-4570, 907-344-4500; FAX: 907-344-4005

Wilderness Sound Products Ltd., 4015 Main St. A, Springfield, OR 97478 503-741-0263, 800-437-0006; FAX: 503-741-7648

Wildey, Inc., P.O. Box 475, Brookfield, CT 06804 203- 355-9000; FAX: 203-354-7759

Wildlife Research Center, Inc., 1050 McKinley St., Anoka, MN 55303 612-427-3350, 800-USE-LURE; FAX: 612-427-8354

Wilkinson Arms, 26884 Pearl Rd., Parma, ID 83660 722-6771; FAX: 208-722-5197

Will-Burt Co., 169 S. Main, Orrville, OH 44667

William's Gun Shop, Ben, 1151 S. Cedar Ridge, Duncanville, TX 75137 214-780-1807

Williams Bullet Co., J.R., 2008 Tucker Rd., Perry, GA 31069 912-987-0274

Williams Gun Sight Co., 7389 Lapeer Rd., Box 329, Davison, MI 48423 810-653-2131, 800-530-9028; FAX: 810-658-2140

Williams Mfg. of Oregon, 110 East B St., Drain, OR 97435 503-836-7461; FAX: 503-836-7245

Williams Shootin' Iron Service, The Lynx-Line, 8857 Bennett Hill Rd., Central Lake, MI 49622 616-544- 6615

Williamson Precision Gunsmithing, 117 W. Pipeline, Hurst, TX 76053 817-285-0064

Willow Bend, P.O. Box 203, Chelmsford, MA 01824 256-8508; FAX: 508-256-8508

Willson Safety Prods. Div., P.O. Box 622, Reading, PA 19603-0622 610-376-6161; FAX: 610-371-7725

Wilson Arms Co., The, 63 Leetes Island Rd., Branford, CT 06405 203-488-7297; FAX: 203-488-0135

Wilson Case, Inc., P.O. Box 1106, Hastings, NE 68902- 1106 800-322-5493; FAX: 402-463-5276

Wilson, Inc., L.E., Box 324, 404 Pioneer Ave., Cashmere, WA 98815 509-782-1328

Wilson Gun Shop, Box 578, Rt. 3, Berry ville, AR 72616 870-545-3618; FAX: 870-545-3310

Winchester (See U.S. Repeating Arms Co., Inc.)

Winchester Div., Olin Corp., 427 N. Shamrock, E. Alton, IL 62024 618-258-3566; FAX: 618-258-3599

Winchester Press (See New Win Publishing, Inc.)

Winchester Sutler, Inc., The, 270 Shadow Brook Lane, Winchester, VA 22603 540-888-3595; FAX: 540- 888-4632

Windish, Jim, 2510 Dawn Dr., Alexandria, VA 22306 703-765-1994

Windjammer Tournament Wads, Inc., 750 W. Hampden Ave. Suite 170, Englewood, CO 80110 303-781-6329

Wingshooting Adventures, 0-1845 W. Leonard, Grand Rapids, MI 49544 616-677-1980; FAX: 616-677- 1986

Winkle Bullets, R.R. 1 Box 316, Heyworth, IL 61745

Winter, Robert M., P.O. Box 484, 42975-287th St., Menno, SD 57045 605-387-5322

Wise Guns, Dale, 333 W. Olmos Dr., San Antonio, TX 78212 210-828-3388

Wiseman and Co., Bill, P.O. Box 3427, Bryan, TX 77805 409-690-3456; FAX: 409-690-0156

Wolfs Western Traders, 40 E. Works, No. 3F, Sheridan, WY 82801 307-674-5352

Wolfe Publishing Co., 6471 Airpark Dr., Prescott, AZ 86301 520-445-7810, 800-899-7810; FAX: 520-778- 5124

W.C. Wolff Co., P.O. Box 458, Newtown Square, PA 19073 610-359-9600, 800-545-0077

Wolverine Footwear Group, 9341 Courtland Dr. NE, Rockford, MI 49351 616-866-5500; FAX: 616-866- 5658

Wood, Frank (See Classic Guns, Inc.)

Wood, Mel, P.O. Box 1255, Sierra Vista, AZ 85636 602-455-5541

Woodleigh (See Huntington Die Specialties)

Woods Wise Products, P.O. Box 681552, 2200 Bowman Rd., Franklin, TN 37068 800-735-8182; FAX: 615-726-2637

Woodstream, P.O. Box 327, Lititz, PA 17543 717-626- 2125; FAX: 717-626-1912

Woodworker's Supply, 1108 North Glenn Rd., Casper, WY 82601 307-237-5354

Woolrich Inc., Mill St., Woolrich, PA 17701 800-995- 1299; FAX: 717-769-6234 6259

Working Guns, 250 Country Club Lane, Albany, OR 97321 541-928-4391

World of Targets (See Birchwood Casey)

World Class Airguns, 2736 Momingstar Dr., Indianapolis, IN 46229 317-897-5548

World Trek, Inc., 7170 Turkey Creek Rd., Pueblo, CO 81007-1046 719-546-2121; FAX: 719-543-6886

Worthy Products, Inc., RR 1, P.O. Box 213, Martville, NY 13111 315-324-5298

Wosenitz VHP, Inc., Box 741, Dania, FL 33004 305-3748; FAX: 305-925-2217

Wostenholm (See Ibberson [Sheffield] Ltd., George)

Wright's Hardwood Gunstock Blanks, 8540 SE Kane Rd., Gresham, OR 97080 503-666-1705
 W. Square Enterprises (See Load From A Disk)
 WTA Manufacturing, Bill Wood, P.O. Box 164, Kit Carson, CO 80825 800-700-3054, 719-962-3570
 Wyant Bullets, Gen. Del., Swan Lake, MT 59911
 Wyant's Outdoor Products, Inc., P.O. Box B, Broadway, VA 22815
 Wyoming Bonded Bullets, Box 91, Sheridan, WY 82801 307-674-8091
 Wyoming Custom Bullets, 1626 21st St., Cody, WY 82414
 Wyoming Knife Corp., 101 Commerce Dr., Ft. Collins, CO 80524 303-224-3454

X

X-Spand Target Systems, 26-10th St. SE, Medicine Hat, ABT1A 1P7 CANADA 526-7997; FAX: 403-528-2362

Y

Yankee Gunsmith, 2901 Deer Flat Dr., Copperas Cove, TX 76522 817-547-8433
 Yavapai College, 1100 E. Sheldon St., Prescott, AZ 86301 602-776-2359; FAX: 602-776-2193
 Yavapai Firearms Academy Ltd., P.O. Box 27290, Prescott Valley, AZ 86312 520-772-8262
 Yearout, Lewis E. (See Montana Outfitters)
 Yee, Mike, 29927 56 Pl. S., Auburn, WA 98001 206- 839-3991
 Yellowstone Wilderness Supply, P.O. Box 129, W.
 Yellowstone, MT 59758 406-646-7613
 Yesteryear Armory & Supply, P.O. Box 408, Carthage, TN 37030
 York M-I Conversions, 803 Mill Creek Run, Plantersville, TX 77363 800-527-2881, 713-477- 8442
 Young, Paul A., RR 1 Box 694, Blowing Rock, NC 28605-9746
 Young Country Arms, P.O. Box 3615, Simi Valley, CA 93093
 Yukon Arms Classic Ammunition, 1916 Brooks, P.O. Box 223, Missoula, MT 59801 406-543-9614

Z

Z's Metal Targets & Frames, P.O. Box 78, South Newbury, NH 03255 603-938-2826
 Zabala Hermanos S.A., P.O. Box 97, Eibar, SPAIN 20600 43-768085, 43-768076; FAX: 34-43-768201 (U.S. importer—American Arms, Inc.)
 Zander's Sporting Goods, 7525 Hwy 154 West, Baldwin, IL 62217-9706 800-851-4373 ext. 200; FAX: 618-785-2320
 Zanoletti, Pietro, Via Monte Guglielmo, 4, I-25063 Gardone V.T., ITALY (U.S. importer—Mandall Shooting Supplies, Inc.)
 Zanotti Armor, Inc., 123 W. Lone Tree Rd., Cedar Falls, IA 50613 319-232-9650
 Z-Coat Industrial Coatings, Inc., 3375 U.S. Hwy. 98 S. No. A, Lakeland, FL 33803-8365 813-665-1734
 ZDF Import Export Inc., 2975 South 300 West, Salt Lake City, UT 84115 801-485-1012; FAX: 801-484- 4363
 Zeeryp, Russ, 1601 Foard Dr., Lynn Ross Manor, Morristown, TN 37814 615-586-2357
 Zeiss Optical, Carl, 1015 Commerce St., Petersburg, VA 23803 804-861-0033, 800-388-2984; FAX: 804-733-4024
 Zero'Ammunition Co., Inc., 1601 22nd St. SE, P.O. Box 1188, Cullman, AL 35056-1188 800-545-9376; FAX: 205-739-4683
 Ziegel Engineering, 2108 Lomina Ave., Long Beach, CA 90815 310-596-9481; FAX: 310-598-4734
 Zim's Inc., 4370 S. 3rd West, Salt Lake City, UT 84107 801-268-2505
 Z-M Weapons, 203 South St., Bemardston, MA 01337
 Zoli, Antonio, Via Zanardelli 39, Casier Postal 21, I- 25063 Gardone V.T., ITALY
 Zonie Bullets, 790 N. Lake Havasu Ave., Suite 26, Lake Havasu City, AZ 86403 520-680-6303; FAX: 520-680-6201
 Zriny's Metal Targets (See Z's Metal Targets & Frames)
 Zufall, Joseph F., P.O. Box 304, Golden, CO 80402- 0304